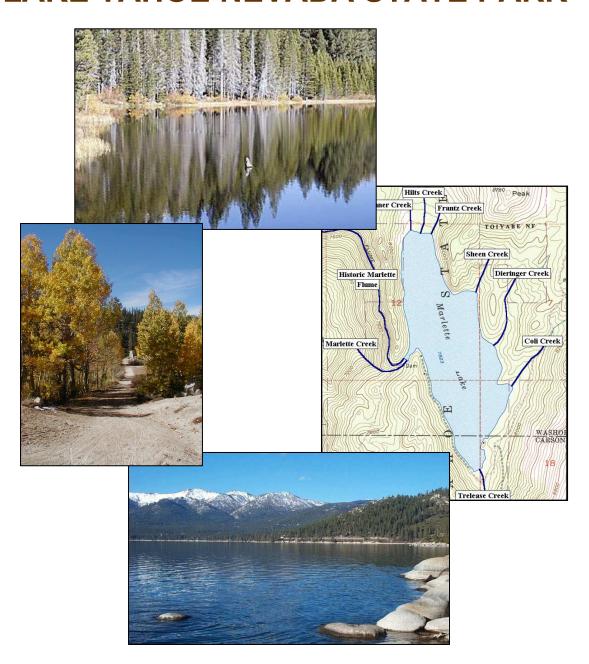
LAKE TAHOE NEVADA STATE PARK



Resource Management Plan

July 2010



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INTRODUCTION

Within the State of Nevada there is a wealth of outstanding natural and cultural resources, many of which have been placed in the trust of the Nevada Division of State Parks. Nevada State Parks was given the task or preserving these resources in 1949 and was officially established as an agency in 1963. The 1963 Legislature passed a bill to form a new state park agency within the Department of Conservation and Natural Resources on April 19th and reorganization of the agency as a Division within the Department of Conservation and Natural Resources became effective July 1, 1963. The park administrator would henceforth be appointed by and answer to the Department Director. Today the Division of State Parks manages and maintains 25 parks in the State Parks system in two regions statewide (Northern and the Southern Regions).

Key to the management of the parks are the following objectives:

- To continue to manage, protect, operate and maintain existing and future units of the Nevada State Park System.
- To acquire, plan for and develop a well-balanced system of areas of outstanding scenic, recreational, scientific and historical importance.
- Continue to manage and interpret the natural, cultural and recreational resources of the State Park System.

These objectives provide the context for developing the park Resource Management Plan.

PURPOSE AND GOALS

Purpose of the Resource Management Plan

This Resource Management Plan (RMP) is part of and tiers to the park General Management Plan. It is the principal document to guide programs to protect, restore, and perpetuate the natural and cultural resources of Lake Tahoe Nevada State Park (LTNSP) and meet the Division's objectives. The RMP is a composite plan based on the enhancement of outdoor recreation while protecting and enhancing its natural resources and is based on Nevada Division of State Park policies and applicable laws and regulations.

Natural resource management may be defined as those activities directed toward the protection or enhancement of the biotic and physical resources of a park in order to achieve stated goals and objectives. Activities that will lead to achievement of these objectives must include the collection of information required to make management decisions (inventory), a description of existing conditions, the development of management strategies (projects), the implementation of those projects and the subsequent monitoring needed to determine management effectiveness.

The RMP establishes the goals, objectives, and policies for the use, protection and restoration of cultural and natural resources in the park and assists with the attainment of regional planning thresholds in Lake Tahoe Basin portions of the park. This RMP is designed to guide

management as data gaps are filled and should be updated annually as missing inventory information is acquired, and every five years once finalized.

Goals

The RMP serves to guide park management by meeting the following goals:

- providing a framework for inventorying and monitoring the Parks natural, cultural, and recreational resources;
- identifying current and potential problems in the parks' natural, cultural, and recreational resource foundation and developing alternatives for attainment of desired future conditions and;
- identify mitigation measures to prevent unwanted impacts to resources.

POLICY AND REGULATION

Park Policies

Several Division policies apply to resource management activities within the park and serve to direct the development of management objectives. These policies are described below.

Nevada Revised Statutes, Nevada Administrative Code, and State Parks policy allow for the sale or donation of firewood from the park, in accordance with the RMP (NDSP Policy 00-13). Given the condition of forests within the park, the need to reduce the threat of wildfire, and the desire to restore ecosystem function across the landscape, significant amounts of residual material are anticipated.

NDSP Policy 35-01 directs staff to develop general management plans for each park to provide for the long-term development and management of individual units. Resource management plans, along with other plans, are components of park general management plans. The RMP serves to guide management while the general management plan for LTNSP is being updated over the next several years.

The Division recognizes that special designations apply to parts or all of some parks to highlight the additional management considerations that those designated areas warrant, as outlined in NDSP Policy 35-2 (Appendix M). These designations include Natural Area, Primitive Area, and Cultural Area. These designations do not reduce the Division's authority for managing the parks, although in some cases they may create additional management requirements.

Natural Areas - A Natural Area designation within any unit administered by the Division must be primarily a consequence of outstanding natural features and are intended to promote experiences closely associated with plant or animal communities or geological formations or scenic features of statewide significances. The management emphasis will be on the natural feature(s). The area must deserve special status for increased protection or preservation. A Natural Area may be identified on the ground with appropriate signs and will be designated in the relevant general management plan.

Primitive Areas - Primitive Area designation will be to protect a unique natural setting in which the opportunity for solitude is the dominant feature. An area with this designation may be contained within any unit administered by the Division. Such an area is managed primarily to prevent degradation of natural conditions, opportunities for solitude or primitive recreation and special features. Motorized use within a primitive area will be limited or non-existent. Such an area must deserve special status for increased protection or preservation. A Primitive Area may be identified on the ground with appropriate signs and will be designated in the relevant general management plan.

Cultural Area - Cultural Areas within any unit administered by the Division are designated to preserve and protect historical, archeological and paleontological resources. They are intended to provide a direct link for the park visitor with Nevada's past. Such an area can include historical buildings or a group of historical buildings, battlegrounds, town sites, significant sites of native culture, historical trails or routes, arts or other sites associated with a significant person or event. A Cultural Area may have a variety of complimentary visitor facilities while a historic site will have little or no complementary development. The management emphasis for both types would be on the historical cultural features. The area must deserve special status for increased protection or preservation. A Cultural Area may be identified on the ground with appropriate signs and will be designated in the relevant general management plan.

Laws and Regulations

The Nevada Division of State Parks is comprised of a system of individual parks administered by the Nevada Department of Conservation valued for their intrinsic natural, cultural, and recreational significance. Chapter 407 of the Nevada Revised Statutes constitute the primary authority for administration of the Nevada State Park System. Under NRS 407.013 Declaration of legislative intent, the NDSP "shall acquire, protect, develop and interpret a well-balanced system of areas of outstanding scenic, recreational, scientific and historical importance for the inspiration, use and enjoyment of the people of the State of Nevada and that such areas shall be held in trust as irreplaceable portions of Nevada's natural and historical heritage" (Added to NRS by 1961, 177; A 1977, 1128) (emphasis added). Under NRS 232.135, the Division of State Parks is administered by an Administrator who is responsible to the Director of the Department of Conservation of Natural Resources.

In addition to the above, management within the park is coordinated with other agencies with resource protection and/or planning responsibilities. These include, but are not limited to, the Nevada Division of Forestry (NDF), the Division of Environmental Protection (NDEP), the Department of Wildlife (NDOW), the State Historic Preservation Office, and in the Tahoe Basin, the Tahoe Regional Planning Agency.

Tahoe Regional Planning Agency

The Tahoe Regional Planning Agency (TRPA) is a bi-state land use planning and regulatory agency responsible for working with local, state, and federal partners in the Tahoe Basin to achieve environmental thresholds as stated in their Regional Plan. Regulations (ordinances) and planning direction applicable to resource management in the park are summarized below. Note

that TRPA regulations only apply to that portion of the park that is located within the Lake Tahoe basin

Regional Thresholds

Within the Regional Plan, TRPA has established environmental goals and related environmental threshold carrying capacities and standards, also known as "thresholds" to help protect Lake Tahoe and to provide a means to allow for additional growth in the region. There are nine threshold categories, which include: air and water quality, soil conservation, vegetation, noise, recreation, scenic resources, and fish and wildlife. Although currently under revision, the current Regional Plan identifies 36 threshold indicators, which are used to track and measure if thresholds are being attained. These include attaining and maintaining certain numbers of nesting sites for bald eagles, ospreys, and northern goshawks; maintaining historic Tahoe Yellow Cress population sites; turbidity and nutrient standards; and Persons At One Time (PAOTS) allocated to recreation sites throughout the basin. Threshold attainment is reviewed and reported every five years for each indicator.

Plan Area Statements

Plan Area Statements (PAS) provide a description of land use for each designated area and establish specific planning direction and include plan maps. PAS also provide specific regulations for identified areas such as would be found in zoning maps, and are identified as allowable or special uses. Only those uses listed within the PAS are allowed within the area; any other activity is prohibited. General management plans, redevelopment plans, and specific plans consistent with the PAS may be adopted to replace the PAS. Permissible uses found in PAS include activities such as outdoor recreation concessions, fuels treatment, or day use areas.

Several PAS apply to the park. These are:

- Tunnel Creek (047)
- East Shore (55)
- Marlette Lake (056)
- Spooner Lake (057)
- Cave Rock (062)
- Kingsbury Drainage (080)

Land Coverage

Chapter 20 of the Code of Ordinances sets forth regulations for the amount of land coverage in the Region. In particular, it stipulates that no land coverage on a given parcel of land may be in excess of the limitations set forth in the chapter and is determined by using the coefficients set forth in the report entitled, Land Capability Classifications of the Lake Tahoe Basin (R.G Bailey,

1974). Land Coverage relative to the park is described more fully in Section III of this document.

Under a proposed revised Memorandum of Understanding (MOU) between the Nevada Division of State Parks (NDSP) and the Tahoe Regional Planning Agency (TRPA), restored, banked, and new coverage will be tracked and reported by NDSP. Under the proposal, up to 1% of total land coverage will be allowed within the basin portion of LTNSP, regardless of land classification. The purpose of this is to avoid the need to pay Excess Coverage Mitigation fees. However, use of banked coverage for project mitigation to avoid Water Quality Mitigation fees will still be tracked by land capability class and meet the requirements of Chapter 20 of the TRPA Code of Ordinances.

A spreadsheet has been developed to provide a centralized tracking system for all Park-related coverage. The Parks EIP staff member has been designated to track coverage, manage the spreadsheet, and provide coverage information to staff as needed (e.g., project permitting).

Code of Ordinances

TRPA's Code of Ordinances is the regulatory document for the agency and outlines required project permits, development and coverage standards, resource management standards, and water and air quality requirements in applicable Chapters. The Code also identifies activities that are considered to not have substantial environmental effects and therefore are exempt from its review and approval. These are outlined in Chapter 4 of the Code and include activities such as maintenance and repairs, dead tree removal, and certain temporary activities. Additional activities ("qualified exempt") are not subject to review and approval by TRPA if the applicant certifies on a TRPA qualified exempt form that the activity fits into specific categories and the activity does not result in the creation of additional land coverage or relocation of existing land coverage. The statement must be filed with TRPA at least three working days before the activity starts.

Several Code chapters have significant implications for management within the park and are summarized below. The list is not exhaustive, however, and staff should always consult with State Parks Planning and Development (P&D) prior to initiating any project activities to ensure all applicable portions of the Code are being met.

Chapter 20, *Land Coverage*, creates and describes TRPA's land capability system, land capability districts, prohibitions of additional land coverage in certain land capability districts, and the transfer and mitigation of land coverage within the Tahoe basin. This chapter is described above and in Section III of this document.

Chapter 25, *Best Mangement Practices Requirements*, outlines requirements for Best Management Practices (BMP's), including temporary BMPs for construction projects and permanent BMPs, in accordance with the Handbook of Best Management Practices.

Chapter 26, *Signs*, describes regulations for signs at recreation areas and facilities which are operated by Nevada State Parks and similar agencies. Under this Chapter, signs are required to conform to the standards enforced by the State of Nevada as set forth in the State of California Department of Parks and Recreation Sign Handbook, 1973, as amended. However, under a

proposed revised MOU, signs will need to meet guidelines outlined in the *Lake Tahoe Recreation Sign Guidelines*.

Chapter 29, *Historic Resource Protection*, states that sites, objects, structures, or other resources, designated as historic resources or for which designation is pending, shall not be demolished, disturbed, removed, or significantly altered, unless TRPA has approved a resource protection plan to protect the historic resources.

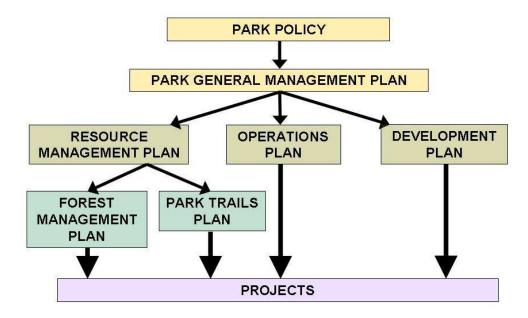
Chapter 50, *Shorezone*, governs all shorezone projects and activities and provides definitions for the shorezone. Projects located in the shorezone (e.g., Sand Harbor or Cave Rock) must comply with the applicable Shorezone Tolerance District Standards set forth in this section, including restrictions related to scenic impacts.

Chapter 71, *Tree Removal*. The purpose of this chapter is to regulate the management of forest resources to achieve and maintain the environmental threshold standards for species and structural diversity, promote the long term health of the natural resources, restore and maintain suitable habitats for native wildlife species, and reduce accumulations of hazardous fuels. Retention standards and permitting requirements are outlined in this Chapter.

Chapter 78, *Wildlife Resources*, provides standards to protect and enhance wildlife habitats, with special emphasis on protecting or increasing habitats of special significance, such as deciduous trees, wetlands, meadows, and riparian areas. No project or activity is permitted within the boundaries of an SEZ except as otherwise permitted for habitat improvement, dispersed recreation, vegetation management, or as provided in Chapter 20. Requirements for the retention of snags and coarse woody debris in conservation and recreation plan area statements are included.

RELATIONSHIP TO OTHER PLANS

The following diagram illustrates the relationship between Resource Management Plan and other related NDSP planning documents.



MANAGEMENT UNITS

Lake Tahoe Nevada State Park (LTNSP) is situated in the northwestern portion of Nevada and is one of the systems' largest parks, covering approximately 14,301 acres. It encompasses an area of the Sierra Nevada range above Carson City and Washoe Valley, approximately 50 % of which lies in the Lake Tahoe basin. Lake Tahoe straddles the California-Nevada border along the western edge of the Great Basin and is the second deepest lake in the United States. The maximum water depth of the lake is 1,645 feet and its surface area is 193 square miles.

As described in the LTNSP General Management Plan, the park is comprised of several distinct management unit areas:

- Sand Harbor (53 acres)
- Spooner Lake (1,140 acres)
- Marlette / Hobart Backcountry (Backcountry) (12,183 acres)
- Highway 28 Corridor (40 acres)
 (includes Hidden Beach and Memorial Point)
- Cave Rock (3.2 acres)
- Van Sickle Bi-State Park (747.5 acres)

These six management areas were developed to assist in the overall management of the park by developing strategies for each unit's unique operations and resources. The management areas are described more fully below and depicted in Appendix J.

Sand Harbor

Sand Harbor is an extremely popular beach area located on the southern shoreline area of the park and west of State Route 28. It receives the heaviest levels of visitation (nearly 467,000 visitors in 2008). The 8.6-acre Sandy Beach parcel, as it was known in the 1950's, was first used by the recreating public in 1958 under lease from then landowner George Whittel. At the time, Whittel was the largest landowner of east shore properties with over 30,000 acres. Further acquisition efforts with Whittel in 1967 ended with condemnation proceedings initiated by the State and resulted in the



purchase of 5,300 acres and approximately four miles of shoreline. Development of Sand Harbor as a state recreation area continued through phased construction and a dedication ceremony on September 11, 1971.

The Sand Harbor management unit is comprised of the main beach area to the south, Sandy Point, Diver's Cove, a group use facility, boat ramp and Boat Beach, picnic area, and a park office/maintenance area. Separate entrances exist with separate fee booths for the main part of the park and the boat ramp. Sand Harbor is open year around with the heaviest use period occurring from June through mid-September, with the number of daily visitors being limited by the number of parking spaces in the park. Popular activities range from sunbathing, swimming, boating, picnicking, scuba diving, weddings, and other beach and group events. The park is host to various theatrical and music events throughout the summer, most notably the annual Shakespeare Festival located at the park's stage facility in the bowl area of Sandy Point. In 2007, a recently constructed visitor's center and food concession/park store was officially opened.

This management unit description includes portions of park ownership located along the Highway 28 corridor between the road and the lake. Additional portions of this management unit are Memorial Point, Hidden Beach, and miles of remote rocky shoreline areas. Facilities at Memorial Point include short-term visitor parking directly off of State Route 28, restrooms, and several short trails providing access to shoreline boulders along Lake Tahoe. Hidden Beach contains a 0.5-acre beach that is a favorite of locals, as it is only accessible from the water or via hiking trails. A two mile hiking trail connects Sand Harbor with Memorial Point and Hidden Beach and provides a number of formalized access trails for dispersed shore access.

Spooner Lake

The Spooner Lake management unit consists of approximately 1,140 acres of forested land located northeast of the intersection of Highway 50 and State Route 28. It encompasses the Spooner Lake and Spooner meadow areas that were purchased from George Whittel in 1970 after condemnation proceedings. Development of sanitation, picnic, and group use facilities followed shortly thereafter. This portion of the park serves visitors to Spooner Lake, a shallow 100-acre historic Comstock-era millpond reservoir approximately 22 feet deep. The modern earthen dam was built in 1982 by the Nevada Division of State Parks to create the state's first catch and release trout fishery (now catch and keep). Osprey and bald eagles put on dazzling aerial fishing displays. Springs, seeps, and snowmelt feed the reservoir, as there are no feeder streams to the waterbody. The level of the lake is managed to protect from inundating nearby pre-historic "grinding stones" of the Washoe Indian tribe who used Spooner extensively as a summer food gathering and worship area.



Today, Spooner Lake is a heavily used, major hiking, mountain biking, and equestrian trailhead for the Marlette-Hobart Backcountry area, accommodating nearly 110,000 visitors in 2008. Along the northern edge of the management unit is North Canyon, a primary portal to the park's remote natural areas. Immediately adjacent to unit's southeastern boundary is another trail facility, the Spooner Summit Trailhead of the Tahoe Rim Trail. Spooner offers tremendous interpretive potential, including the Spooner Lake Interpretive Loop encompassing the

perimeter of the lake, wildflower walks, and evening star gazing. Spooner Lake, Inc., a contracted concession operation, operates out of a previous group use facility and offers equipment rentals on mountain bikes, snowshoes, and cross-country skis as well as maintaining miles of groomed ski trails and two backcountry cabin rentals. Although mountain biking has recently been the dominant recreational use, visitors also enjoy the picnicking, fishing, hiking, equestrian, and nature study opportunities at this area.

Marlette-Hobart Backcountry

The Marlette-Hobart backcountry ("backcountry") is the largest and least developed of the LTNSP units and covers the majority of the upper elevations east of State Route 28 from Spooner Lake north to just beyond Tunnel Creek. There are several access points into the backcountry, including North Canyon from Spooner Lake, Tunnel Creek road, Musgrove Canyon from the northeast; and Lakeview and Ash Canyon roads from the east.

Management of the backcountry areas by NDSP began in 1963 when 5,400 acres in the vicinity of Marlette Lake and the associated historic water system were purchased. An additional 2,757 acres were added to the backcountry with North Canyon and portions of Spooner meadow during a 1970 acquisition. The park administers the backcountry as a state primitive area. As outlined by Nevada State Parks Policy 35-2, this designation is a protected natural environment managed to prevent degradation of the natural conditions and to provide opportunities for solitude or primitive recreation and special features. As such, motorized vehicular travel is prohibited with the exception of administrative purposes. A motorized backcountry travel permit system is in place that allows for very limited travel by other government agencies, research personnel, and private landowners. Limited improvements in the backcountry include a minimally developed system of utility roads and trails, interpretive signage, several campsites in three designated primitive campgrounds, and the remains of historic Comstock-era logging, grazing, and water supply systems.

The more than 12,000 acres of the backcountry include four lakes, an ephemeral pond, six stream systems and numerous tributaries, forest and meadow ecosystems, nine peaks over 8,000 feet in elevation, and habitat types exhibiting an enormous amount of flora and fauna (see maps in Appendix J). Red fir and Jeffrey pine forest types are dominant and support wildlife species such as blue grouse, mountain quail, mule deer, black bear, bobcat, pine marten, mountain beaver, golden-mantled ground squirrels, northern flying squirrels, short- and long-tailed weasles, and various other hawk, owl, and songbird species. Northern goshawk, osprey and bald eagle disturbance zones are located in this unit.

The backcountry experiences heavy visitor use in a limited dispersal pattern associated almost exclusively with the road and trail system. Some very popular portions of the backcountry are the North Canyon road leading from Spooner Lake to Marlette Lake, the Marlette Lake Trail (a hiker and equestrian alternative to the North Canyon road), the Marlette and Red House Flume Trails, the Backcountry Loop Trails, the Marlette – Chimney Beach Trail, and the Tahoe Rim Trail (see Management Zone map in Appendix J). Special scenic features of the backcountry include Marlette Reservoir, upper and lower Twin Lakes, Hobart Reservoir, and historic structures such as Spencer's Cabin, Red House, and Hannah's Cabin. Summertime activities include fishing, equestrian travel, mountain biking, nature study, photography, hiking, and camping. Wintertime

activities include cross-country skiing and snowshoeing. As mentioned previously, a concession operates in the backcountry to further enhance the visitor experience by offering groomed trails and equipment rentals as well as two remote Scandinavian-style backcountry cabin rentals: the Spooner Lake cabin, located just beyond the northern edge of Spooner, and the Wildcat cabin, located several miles further north.

Cave Rock



Cave Rock is a small, 3.2-acre parcel of land on the shoreline of Lake Tahoe approximately five miles south of Spooner Lake on Highway 50 receiving approximately 161,000 visitors annually (2008). It was originally developed as a parking and boat ramp facility in the late 1950's. NDSP assumed management in 1967 from the Nevada Department of Transportation and further developed the site to modern standards. The site offers the recreating public a two-lane boat ramp, a 58-space parking lot, sanitary facilities, and a small picnic and swim beach at the southern end.

The principle element of the Cave Rock management unit is the rock itself. Located adjacent to park property on USDA Forest Service (USFS) land, Cave Rock is an impressive geologic feature consisting of the remnants of an inactive volcanic neck. Cave Rock has figured prominently in the history of the Lake Tahoe Basin and as a landmark symbol has greatly influenced the tourism and economic development of the region. Cave Rock is recognized as one of the unmistakable visual hallmarks of Lake Tahoe, appearing in countless promotional publications. It is also a significant cultural symbol for the Washoe Indian Tribe and commands the highest respect among the Native American community, serving as a site where the Washoe engage in traditional activities in relative isolation. Initially in 1931 and later in the 1957, highway designers and construction workers blasted through Cave Rock to construct the two double-lane tunnels for Highway 50, with the tunnel waste rock becoming the base for the parking lot and boat ramp. During the 1980's and 1990's, Cave Rock became known regionally and internationally as an extremely challenging and technically demanding feature for sport climbing. A recent Record of Decision by the USFS (2003) prohibits rock climbing at Cave Rock.

Van Sickle Bi-State Park

The master planning process for the Henry Van Sickle unit of LTNSP was recently completed and phased park construction began in 2009. The property originally consisted of 542 acres of land located directly behind Harrah's Hotel and Casino in Stateline, Nevada directly adjacent to California. The land was donated to Nevada State Parks in 1988 from Jack Van Sickle, grandson of Henry, with the express stipulation that it be developed as a state park and named after his grandfather. Several years later, the 28-acre Amacher Schultz property, previously owned by the State of Nevada and managed by the Nevada Division of State Lands (NDSL), was added to the

unit to bring it to a total of 570 acres. In 2003, Jack Van Sickle sold 155.5 acres to the State of California, which was added to an existing 20-acre parcel under their ownership and a 2-acre donation, bringing the entire park acreage to approximately 747.5 acres. Although Van Sickle is currently managed as a unit of LTNSP, the master plan has facilitated the creation of Nevada's first bi-state park that is jointly administered with the State of California as a result of this last acquisition. Under the master plan, facilities such as trailhead, parking, picnicking, camping, and group use facilities are envisioned. There is also a tremendous interpretive potential since the park has an array of historic structures located in California that include a 2,040 square foot barn built in the early 1860's, a log cabin built in 1914, and ten cottages built in the 1930's and 1940's.

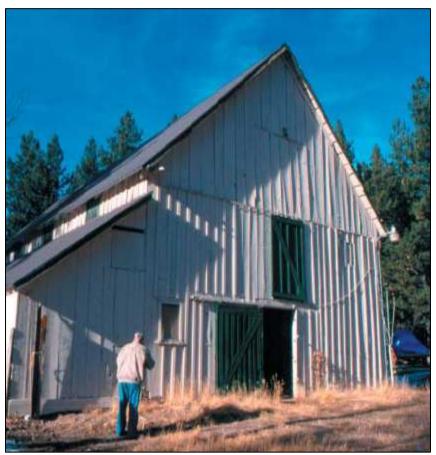


Figure 1. Historic barn structure (CA side of park).

Van Sickle quickly rises from near-lake level at 6,400 feet to lofty slopes in the east at nearly 8,000 feet elevation. It is a remote natural area untouched by development other than a few miles of unimproved dirt roads historically used by equestrians. Forest types are typical of other portions of the park. Red fir and Jeffrey pine are the dominant overstory species associated with western white pine, white fir and commonly found understory shrubs such as ceanothus. Stands of sugar pine and aspen are also located throughout the property. Edgewood Creek runs just north of the property, which is bisected by two of its major tributaries. The site includes suitable habitat for several sensitive wildlife species, including northern goshawk, American marten, California spotted owl, black bear, mule deer, blue grouse, pileated woodpecker, willow flycatcher, and osprey. In 2002, the 673-acre Gondola fire burned 249 acres of the park. The

fire began at the Heavenly Ski Resort gondola adjacent to the park and burned upslope to the northeast, with a majority of the high intensity burns areas located on state land. As a result, rehabilitation of the burn areas and monitoring will be an important aspect of resource management for this area.

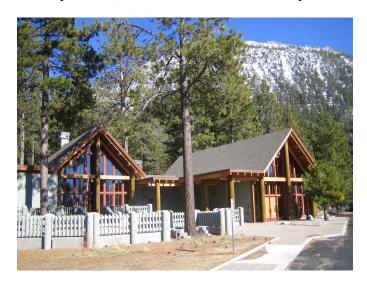


Figure 2. Gondola Fire burn area recovery (2008).

MANAGEMENT ZONES

Within each unit, management of natural resources is based on the park's management zones, as established in this resource management plan. Management zones include natural zones, cultural zones, development zones, and special use zones.

Park development zones are managed for more concentrated visitor uses that may require manipulation or alteration of the natural resources present. However, such manipulation should be limited to the minimum needed to support the intended levels use. In addition, where development zones are adjacent to natural zones, management should be geared to maintaining as natural an environment as possible, and to minimize adverse impacts on the natural zone.



The primary management objective in **cultural zones** is to protect and foster appreciation of the cultural resources; natural resource management actions are designed to support cultural resource management objectives (e.g., maintenance of a historic landscape). While cultural resource objectives take precedence over natural resource objectives, natural resource policies are to be followed wherever they are compatible with cultural resource objectives.



By definition, **special use zones** are managed and used for activities not appropriate in the other zones, such as commercial uses. Within LTNSP, there are several current special uses operated through private concession contracts, including: the Shakespeare Festival stage and a food service and amenity store at Sand Harbor; groomed Nordic ski trails and rentals in the winter at Spooner Lake and throughout the Marlette-Hobart Backcountry; mountain bike rentals in the summer operating out of Spooner Lake, primarily for the Flume Trail; and two rustic rental cabins in North Canyon.



In **natural zones**, the primary objective of management is to maintain natural resources and ecological processes in as natural a condition as possible, while allowing for their enjoyment by current visitors and ensuring their availability for future generations. Restoration of damaged or degraded ecosystems is also an objective in natural management zones.



Within natural zones, several special management zones are designated. These include Late Successional/Old Growth (LSOG), Riparian (which includes aspen stands and wetlands), Fuel Break, and Shoreline. These are briefly described below:

Late Successional/Old Growth (LSOG) zones are areas within the park that exhibit old growth characteristics, namely the presence of large (>24" dbh) trees and logs, generally open understory, and multiple tree canopies. Designated LSOG areas may exhibit all of these characteristics or have the potential to do so in the near future following management activities. A definition for LSOG within the park is provided in Appendix C.

Riparian zones are transitional areas between terrestrial and aquatic ecosystems that are adjacent to streams or lakes. These areas are significantly influenced by aquatic ecosystems through groundwater and surface water interaction, as is exhibited by the vegetation that grows there. Species associated with riparian areas within the park include several species of willow, alder, dogwood, cottonwood, and aspen.

Fuel Breaks are designated by the Park Supervisor and generally are strips or blocks of land that emphasize the reduction of forest and shrubland fuels as the primary management goal in order to reduce the spread of wildfire. Spacing between vegetation will be greatest in fuel breaks, relative to other areas within the park. Fuel breaks are generally located along roads, but may also be designated based on changes in topography or vegetation, or in proximity to important structures or natural features. Fuel breaks may also be designated in naturally occurring areas such as open, sparsely vegetated sandy bowls or rocky outcrops.

Shoreline zones include portions of the park from Hidden Beach to south of Sand Harbor below State Route 28, and Cave Rock. This zone includes both TRPA's designated Shorezone areas and additional sensitive areas identified by NDSP.

Management Zone Goals and Objectives

The natural communities of Lake Tahoe Nevada State Park provide important habitat for many plant, fish and wildlife species, and allowing natural processes such as fire or flooding to occur is crucial for the perpetuation of these communities. Where natural processes have been substantially altered or interrupted by human influences, attempts should be made to restore processes to more naturally sustainable conditions. Restoration activities should be directed toward self-maintaining levels, where possible.

Goals outline the primary focus of each management zone and help to describe the vision for each zone. Goals for each management zone are described below, and where appropriate, objectives are listed for each goal. Several special designation areas that are found within multiple management zones are included as well.

<u>Park Development</u> – the primary goal within the Park Development management zone is to maintain consistency with the park General Management Plan by maintaining a more formal setting for park visitors. This includes the presence of facilities for special activities or to accommodate intensive use, and often the concentration of large numbers of users. Multiple land management practices are needed to balance the need for intensive use with the desire to maintain and minimize impacts to the natural environment.

- Objective 1: Where new utility infrastructure or facilities associated with public services are needed to serve the Park, minimize impacts to sensitive Park resources.
- Objective 2: Reduce and, where possible, eliminate wildlife access to human food and garbage by using wildlife-proof trash containers in the park, including administration and residence areas.
- Objective 3: The visual features of the landscape at Sand Harbor are an extremely important aspect of the recreational experience. Planning efforts should work to protect the visual quality of the area and maintain established visual objectives.
- Objective 4. Balance the need for protection, preservation and, where necessary, restoration of natural ecosystem elements and processes, with an enjoyable and educational visitor experience.
- Objective 5. Evaluate the capacities of day use areas and facilities to determine the quality of the visitor experience. Determine if management plans or visitor capacity limits for any of the facilities are needed to maintain a quality experience for the visitors and maintain the natural character of the Park.

Cultural – Preserve archeological, historical and paleontological resources

- Objective 1: Prevent damage to resources as a result of the implementation of management or development activities (e.g., hazard tree removal or trail construction).
- Objective 2: Implement management activities to protect resource, including stabilizing structures in a state of "arrested decay", rehabilitation, or full restoration.
- Objective 3: Provide a buffer for the protection of especially significant Park historic and prehistoric archaeological sites or properties.
- Objective 4. Identify cultural resources within the Park that may be eligible for inclusion in the National Register of Historic Places and/or the California Register of Historic Resources. Significant structures should be nominated for listing in the National Register of Historic Places.
- Objective 5. Periodically inspect and monitor historic structures, with a priority given to National Register-listed or eligible structures.
- Objective 6. Foster appreciation of the Park's cultural resources through the implementation of appropriate interpretive displays and programs.

<u>Special Use</u> – Faciliate appropriate uses consistent with park General Management Plan, adjacent management zones, and carrying capacity.

- Objective 1: Evaluate the capacities of day use areas and facilities to determine the quality of the visitor experience. Determine if management plans or visitor capacity limits for any of the facilities are needed to maintain a quality experience for the visitors and maintain the natural character of the Park.
- Objective 2: Balance existing facilities and the need for potential new public facilities, such as trails and staging areas, with their potential adverse impacts to plant and wildlife species, sensitive natural communities, and cultural resources.
- Objective 3: Identify opportunities to realize net environmental benefits to the park as a result of the approval of special use permits.

<u>Natural</u> – Manage to preserve natural appearance, wildlife habitat, and restore or mimic natural processes.

- Objective 1: Manage most of the land within the park as Natural Management Zone in perpetuity. Protect and manage the natural ecosystem elements and processes to promote an undeveloped wilderness character and the expected visitor experience.
- Objective 2. Manage and maintain public and administrative access to the Park and its periphery through a system of maintained roads and trails that is consistent with protecting Park resources.
- Objective 3: Manage to provide for the protection and sustainability of significant natural resources. Promote the restoration and expansion of aspen communities and sugar pine
- Objective 4: Promote natural processes and ecological functions. Restore fire as an ecological process in the Park to manage natural ecosystems and control hazardous fuels.
- Objective 5. Restore forest and meadow vegetation to a healthy, resilient vegetative community that approximates the natural state, while recognizing past human impacts and current uses.
- Objective 6. Minimize the use of hardened surfaces or reduce their impacts in the floodplain to avoid downstream effects.
- Objective 4: Monitor and take appropriate actions to protect the the environment from possible impacts caused by visitor use, trails, and maintenance.

Late Successional/Old Growth (LSOG)

- Objective 1: Manage old-growth stands in perpetuity by establishing special protection and designation for this highly significant ecosystem.
- Objective 2. Manage second-growth forests to move them towards displaying old-growth forest characteristics within the park to approximately 55% of the total forested area through the implementation of restoration activites. Activities should be prioritized to provide connectivity between existing old-growth stands.
- Objective 3. Restore the natural fire regime to the maximum extent possible.
- Objective 4: Monitor and take appropriate actions to protect the old-growth stands from possible impacts caused by visitor use, trails, and maintenance.

Riparian

- Objective 1: Increase the acreage of riparian habitat throughout the park, where feasible.
- Objective 2: Restore degraded areas where they cannot be expected to recover on their own in a reasonable timeframe if left untreated.
- Objective 3: Manage habitat features that are important to neotropical songbirds and other riparian-dependent species such as mountain beaver.
- Objective 4: Avoid fragmentation and promote connectivity of large intact plant communities and habitats when constructing new facilities and siting trails.
- Objective 5. Manage invasive weeds to decrease or eliminate their populations to maintain naturally functioning ecosystems.
- Objective 6. Size and design culverts beneath roads and trails to accommodate a 100-year storm event and minimize impacts to fish and wildlife movement.

<u>Fuel Break</u> - Fuel breaks serve as barriers to the movement of wildfire, as well as presenting a low risk "point of ignition" zone surrounding travel alignments by modifying fuel behavior, slowing rates of spread, and reduction fire intensity and severity. Fuels breaks are strategically established to minimize the risk of ignition in high use areas, provide a staging area for firefighting personnel during wildfires, and break up the horizontal continuity of upper canopy vegetation to reduce crown fire potential or cause crown fires to become ground fires and lose intensity.

- Objective 1: Reduce the threat of catastrophic wildfire.
- Objective 2: Reduce resistance to control and aid in successful initial attack using either direct or indirect tactics.

• Objective 3: Significantly reduce surface, ladder, and canopy fuels to the extent needed to sufficiently alter potential fire behavior.

<u>Shoreline</u> – Preservation of the scenic character of the Lake Tahoe shoreline is a critical element of the park.

- Objective 1: Maintain dispersed recreation opportunities through a system of developed trails and remove user-created trails and related erosion problems.
- Objective 2: Preserve and protect the undisturbed scenic quality of shoreline, minimizing visible human-made structures.
- Objective 3: Support the elimination of unauthorized roadside parking along State Route 28.

Resources

Lake Tahoe Nevada State Park occupies a portion of the large, high altitude fault block valley making up the Lake Tahoe basin, as well as high elevation portions of the Carson range. The resource inventory includes a general description of the various living and non-living components of the park, as well as the specific elements of each component that have been catalogued. Impacts from past and current activities have resulted in the degradation of some of these components, which are described following the discussion of park resources. More detailed inventory descriptions that have been undertaken within the park are found in the appropriate appendices of this document.

Physical

Physical natural resources of the park include soils and their geologic parent material, water, and scenic attributes. The natural character of the park, including forested areas, shoreline, and rock outcrops, contributes to its exceptional scenic quality. The development of facilities to meet the needs of visitors, however, can detract from these visual elements if they dominate the landscape or do not compliment the surrounding setting. Similarly, the presence of excessive roads and related maintenance facilities, non-uniform signage, and delayed maintenance can negatively impact scenic quality.

Climate

The climate along the Carson Range is typical of the Sierra Nevada, with summers dominated by long dry periods with occasional convective storms, and winter months delivering the majority of the annual precipitation in the form of snow. Average annual precipitation ranges from up to 80 inches in the far western portions of Lake Tahoe, while the eastern side ranges from 20 to 35 inches of precipitation. This is due to the "rain shadow" effect that occurs as the air descends the eastern slope, is warmed by compression, and then drops much of the precipitation as it cools on the western edge of the lake.

Snow cover varies from year to year, with bare ground common during many winter months in the Carson Range. At Sand Harbor, the mean annual precipitation is 20 - 25 inches. This amount increases steadily with elevation, and reaches a maximum of 35 inches along the basin divide. The average annual snowfall is 200 - 280 inches at the 7,000 foot elevation.

Average monthly temperatures at the Tahoe City weather station range from 38.5 °F in January to 77.7 °F in July. Winters in the higher elevations are cold, though seldom severe, with the daytime temperatures averaging approximately 44 °F. Summers in the basin are cool and dry, with daytime temperature average 75 °F and night time temperatures average 44 °F. These warmer temperatures are generally due to the stable atmospheric conditions which predominate for several months

Soils and Geology

Lake Tahoe was formed by a combination of basin-and-range type block faulting and damming of the Truckee River outlet in Tahoe City from cyclic episodes of volcanic and glacial activity.

Granite of Jurassic and Cretaceous age forming the Sierra Nevada batholith make up the composition of much of the surrounding landscape, along with remnants of metamorphosed Paleozoic and Mesozoic volcanic and sedimentary rock.

The lake lies in a down-dropped fault block that slipped in response to tensional forces across this part of the Sierra Nevada Mountains. Lava flows and ash-falls, along with glacial debris from the Ice Age, blocked the natural outlet at the north end of the downfaulted block. With the end of the glacial epoch more than ten thousand years ago, silt and sand from the melting glaciers eroded rapidly, depositing layers of sediment on the relatively flat lake bottom. Today, a man-made dam at the outflow of the lake in Tahoe City, CA creates several extra feet of water storage for the lake.

LTNSP is dominated by granitic rock types, as shown on the geologic map of the park found in Appendix J. This map is based upon digital data sources based on the Geologic Map of California (Jennings 1977), Geologic Map of the Lake Tahoe Basin, California and Nevada (Saucedo, et al. 2005) and Geology of the Carson City 30 x 60 Minute Quadrangle (Stewart 1999).

Much of the western portion of the park is mapped as Monzogranite of Spooner Summit of Grose (Ksgr) rock, which is described as white to light-gray, medium-grained idiomorphic, slightly porphyritic with hornblende laths locally to 10 mm long and massive to weakly foliated inclusions 1 to 20 cm long. Along the crest of the Carson Range and eastern portions of the park, undivided fine- to coarse-grained granite and granodiorite (Kgr) dominate and locally may include alaskite, quartz diorite and diorite.

Several Tertiary formations are mapped from the Carson Range crest east along the Marlette Road and beyond Sunflower Hill. Conglomerates (Tc) consist of angular to rounded pebbles to boulders of Tertiary volcanic, pre-Tertiary metavolcanic, and pre-Tertiary mafic plutonic rocks deposited in an east-northeast-trending paleovalley stratigraphically below Oligocene ash-flow tuffs. Lenihan Canyon Tuff (Tlc) is a crystal-rich, moderately to strongly welded ash-flow tuff with phenocrysts of quartz, sanidine, plagioclase, biotite, hornblende, and a trace of opaque oxides. Andesite and basalt formations (Tada) are expressed as a diverse assemblage of local units consisting of generally fine-textured andesite, hornblende andesite, pyroxene andesite, hornblende-pyroxene andesite, and pyroxene basalt.

In the vicinity of Slaughterhouse Canyon, areas of granitic and metamorphic rock are found. Granodiorite of East Peak (Keg) is fine- to medium-grained, well-foliated, equigranular to weakly porphyritic hornblende-biotite granodiorite to quartz monzodiorite. This rock type contains potassium feldspar that locally forms subhedral phenocrysts to 1.5 cm long, and hornblende which occasionally form needles as long as 15 mm. Metamorphic rocks (JTrms) are metamorphosed sandstone, calcareous siltstone and silty limestone. Within the Glenbrook quadrangle this includes metaconglomerate as well.

Several different rock types are found just north of Marlette Lake. These include crystal-rich to crystal-poor, welded and non-welded Oligocene and Miocene age rhyolite tuff (OMvr) from sources in central and western Nevada; unsorted, poorly consolidated granitic colluvium (Oc) comprised of decomposed granite, soil, matrix supported debris flow material, sand and cobble

to boulder gravel; andesite and dacite (Mvaf) that includes massive to platy andesite, hornblendeand pyroxene-andesite flows and dacite flows; and local dikes and intrusions of andesite, basaltic andesite and latite (Mia).

More recent Quaternary deposits are mapped in several areas of the park. Accumulations of coarse angular blocks to gravelly and sandy granitic and volcanic debris talus deposits (Qt) are found at the northern edge of Marlette Lake. Unsorted angular boulder to clay size debris that locally may include talus, colluvium, rockfall and avalanche deposits and accumulations of poorly sorted, disrupted materials transported by debris flows landslide deposits (Qls) and unsorted, poorly consolidated granitic colluvium, decomposed granite, soil, matrix supported debris flow material, sand and cobble to boulder gravel colluvium (Qc) are found along the Franktown Creek drainage. Thin-bedded sandy silt and clay lake deposits (Ql) occur at Twin Lakes. Poorly to moderately sorted silt, sand and gravel forming broad terraces 5 – 10 meters above lake level (Qlt) and moderately sorted, fine to very coarse grained to gravelly arkosic sand beach deposits (Qb) are readily identifiable at Sand Harbor.

The Cave Rock management unit consists entirely of volcanic rock (Mvgi), which is comprised of porphyritic hornblende-sanidine latite intrusions in irregular-shaped intrusive masses and dikes, local vitric-crystal tuff and associated hornblende trachyte flows and vent fill in the Glenbrook quadrangle.

The Van Sickle portion of the park is dominated by granitic rock types. In the more gently sloped portions of the property, Bryan Meadow granodiorite (Kbmg) is found and consists of light-gray, medium-grained locally porphyritic hornblende-biotite granodiorite typically containing about 5 percent subhedral and euhedral hornblende crystals as large as 1 cm, and similar amounts of biotite in a groundmass of feldspar and quartz. In steeper areas, Granodiorite of East Peak (Keg) predominates and is comprised of fine- to medium-grained, well-foliated, equigranular to weakly porphyritic hornblende-biotite granodiorite to quartz monzodiorite. Keg contains potassium feldspar that locally forms subhedral phenocrysts to 1.5 cm long, and hornblende which occasionally form needles as long as 15 mm. Quaternery alluvium (Q) deposits are found along the several drainages that bisect the property and consist of unconsolidated, moderately to poorly sorted sand, silt and gravel.

There are a number of north-south trending faults mapped within the park. These are primarily found along the major drainages (Tunnel Creek, Franktown Creek, North Canyon) and running through Marlette Lake.

Aspects within the park are predominantly east and west facing, with the exception of Van Sickle which is north facing. Elevations generally begin at 6,200 feet near Lakeview and range up to 8,700 feet at Marlette Peak. Most of the soils are shallow, poorly developed, and tend to be comprised of medium acid, very stony sandy loam derived from granitic or volcanic parent material. Soils of these types tend to be unstable, easily disturbed, and highly prone to erosion. Table 1, found in Appendix B, provides a description all soils occurring with the park that are shown in the Appendix J (Maps), as well as the approximate area each soil type covers within the park.

Land capability is defined as "the level of use an area can tolerate without sustaining permanent (environmental) damage through erosion and other causes." Land capability and coverage in the Lake Tahoe Basin is managed primarily by TRPA and are outlined in Chapter 20, "Land Coverage Standards," of the TRPA Code of Ordinances. Land capabilities based on the land capability classification system known as the "Bailey System" are mapped within the park and are depicted in Appendix J. The Bailey System was developed to mitigate negative impacts on stream systems and water quality resulting from excessive land coverage. The system designates land capability district (LCD) classes ranging from 1 to 7 and assigns a percentage of land coverage allowable in the designated LCD area. Class 1 LCD's are identified as being the most susceptible to erosion (and therefore most limiting) and Class 7 being the least. Table 2 provides the distribution of land capability classes with the Lake Tahoe Basin portion of the park.

Table 2. Distribution of land capability by capability class and management unit (acres).

	Management Unit		
Capability Class	Sand Harbor and Marlette Backcountry	Cave Rock	Van Sickle*
1a	5,177	3	561
1b	254	0	49
1c	424	0	12
2	194	0	17
3	0	0	0
4	10	0	90
5	59	0	0
6	126	0	0
7	0	0	0
WB*	353	0	0

^{*}Van Sickle Land Capability acres includes TRPA verified coverage (2003) for lower portion of park and California ownership. WB = Water body.

Hydrology

The water resources of Lake Tahoe Nevada State Park (LTNSP) are as extensive and varied as anything to be found in the surrounding Tahoe basin. Lake Tahoe is the foremost water feature of the region and the most important within park boundaries. Several other stream systems and waterbodies in the park are associated with its sub-basins. Water resources within the park, but outside the basin, are widespread as well. These water systems generally flow into either Carson

City or Washoe Valley and include water pumped from Marlette Lake (within the Tahoe basin) via the historic and still functioning Marlette Water System.

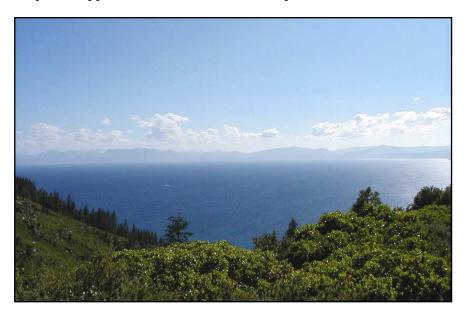
Utilizing the 2006 NHDPlus dataset available from the US Geologic Survey (USGS), a number of watersheds and waterbodies were delineated for the park and are more fully described below. These include:

- Lake Tahoe and its associated stream systems
- Marlette Lake
- Spooner Reservoir
- Bonpland Creek
- Tunnel Creek
- Secret Harbor Creek
- Marlette Creek
- North Canyon Creek
- Franktown Creek
- Lewers Creek
- Musgrove Creek
- McEwen Creek
- Hobart Creek
- Hobart Reservoir
- Twin Lakes

Creeks adjacent to the park boundary with upper watersheds in or near the park are:

- Vicee Canyon Drainage
- Ash Canyon Creek
- Kings Canyon Creek
- Clear Creek

Most of the information regarding these other water systems is quite old and does not include nearly the amount of detail to be found with Lake Tahoe. Because of Tahoe's importance to the region, a significant amount



of scientific data can be found regarding its system constituents. Although Nevada Department of Wildlife (NDOW) management plans do exist for Marlette Lake and Hobart Reservoir, they date back to the late 70's and early 80's and do not approach the level of detail found with Lake Tahoe. Similarly, Spooner Lake currently does not have a management plan. In addition, TRPA is committed to increasing the knowledge base concerning Marlette and Spooner with the 2006 Threshold Evaluation Study. Although some TRPA and Nevada Division of Environmental Protection (NDEP) studies have taken place, additional studies are needed to set threshold standards.

Lake Tahoe

Tahoe has long been admired for its alpine setting and the clarity of its water. It lies at the crest of the Sierra Nevada at an average elevation of 6,225 feet above sea level, surrounded by mountain peaks of the Sierra Nevada on the west and the Carson Range on the east. The basin was formed by downward fault blocking during the uplift of the Sierra Nevada 2-3 million years ago, which resulted in dramatic topographic relief. Mountain peaks, snow capped nearly year round, rise to altitudes above 10,000 feet (Freel peak, 10,887 ft.) with 78% of the region over 6,500 feet. The Lake Tahoe basin totals 506 square miles with 193 square miles of lake surface and 314 square miles of watershed area. This represents a low watershed to lake surface area ratio, suggesting the amount of nutrients entering the lake would naturally be very low. The montane-subalpine watershed is dominated by coniferous vegetation and nutrient-poor soils. Most of the land in the basin is mountainous, limiting major development mainly to relatively flat-lying areas along tributary streams, such as the Upper Truckee River and Trout Creek basins in South Lake Tahoe.

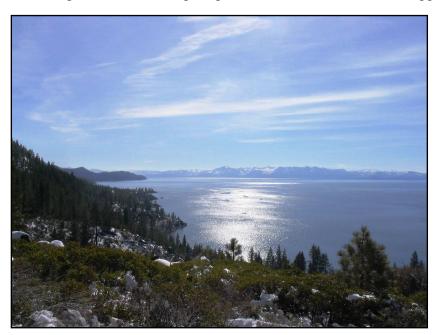
At 1,645 feet deep, Lake Tahoe is the 2nd deepest lake in the United States and 10th deepest in the world. It has an average depth of 1,000 feet. Carson City, at a mean elevation of 4,650 feet, actually lies 82 feet above the bottom-most depths of this enormous lake. A natural rim occurs at an elevation of 6,223 feet above mean sea level but a permanent, concrete dam, built in 1913, extends the maximum lake elevation to 6,229.1 feet. A power syndicate supported by the US Department of the Interior rebuilt the original 1870's dam. The lake is 22 miles long and 12 miles wide with 72 miles of shoreline. Sixty-three watersheds drain into the lake to create an overall volume of 204,040 cubic yards or 122 million-acre feet. Water in the lake has a residence time of about 700 years meaning this is the amount of time required to re-fill an empty basin to current levels. Approximately 352,000 acre-feet per year evaporate from the surface. The California-Nevada Interstate Compact regulates the top six feet of the lake as a reservoir for local and downstream uses. Needs associated with the Truckee River and Pyramid Lake put large demands on this water, often resulting in extensive legal disputes over water rights. An average of 720,000 acre-feet per year for downstream use.

Lake Tahoe resides in two states; approximately 1/3 Nevada and 2/3 California, and 6 counties - Alpine, Eldorado, Placer, Washoe, Carson City, and Douglas. Approximately four shoreline miles of the lake belong to the State of Nevada under the management of the Nevada Division of State Parks (NDSP). There are a total of 63 priority watersheds that drain the region. The Lake Tahoe Interagency Monitoring Program has been monitoring 14 streams since 1980; Trout Creek, Upper Truckee River, General Creek, Blackwood Creek, Ward Creek, Third Creek,

Incline Creek, Glenbrook Creek, Logan House Creek, and Edgewood Creek. Nine of the 36 subbasins can be found within park boundaries yet only one stream is constantly monitored (Edgewood). Past studies by TRPA have found that only North Canyon Creek has excellent water quality. Those streams with good water quality include Marlette Creek and Secret Harbor Creek. The other annual streams within the main part of the park are considered marginal (LTNSP Master Plan, 1990).

Tunnel Creek

Tunnel Creek is 1.5 miles from Sand Harbor on the northeast shore of Lake Tahoe. Its watershed is approximately 1,010 acres in area and contributes about 1,850 acre-feet of water per year from an average of 22 inches of precipitation. The runoff amount is approximately 780 acre-feet a



year. Its headwaters originate north of the historic tunnel of the Marlette Water System (west portal). It also receives seepage from the collapsed tunnel. Tunnel Creek's overall channel length is 1.87 miles. Although it has fairly substantial wintertime flows, it rarely reaches Lake Tahoe late in the summer. NDOW has suggested that there is a probable barrier under Hwy 28 (TRPA and NDOW, 1982).

Bonpland Creek



The Bonpland Creek watershed is just to the south of the Tunnel Creek watershed. It is 670 acres and produces 1,120 acre-feet of water from an average annual precipitation of 20 inches. Of this amount, it is estimated that 780 acre-feet per year is in the form of surface runoff. This stream has a natural barrier at the mouth composed of boulders where the water drops off into the lake. The channel is approximately 1.68 miles and includes a south tributary. Its gradient is steep and water has been observed to flow occasionally under boulders and natural litter. A 0.22 cubic feet

per second (cfs) flow rate was measured in September 1977 although average summer flows probably reach ½ to ¾ cfs (TRPA and NDOW, 1982).

Sand Harbor watershed

The Sand Harbor watershed contains many subtle drainages, but has no substantial stream courses leading into Lake Tahoe. It is approximately 1,050 acres in total area. An average total of 1,840 acre-feet of water is produced within its boundaries from 21 inches of annual precipitation, with 710 acre-feet of this becoming surface runoff (TRPA and NDOW, 1982).



Marlette Creek

Marlette Creek, just south of Sand Harbor, is one of the larger Tahoe watersheds associated with the park at 3,100 acres, although at least half of this area lies outside of park boundaries. It receives an average of 20.4 inches of precipitation, produces 5,260 acre-feet of water, and has 2,000 acre-feet of surface runoff annually. Marlette Creek is located approximately 2 miles south of Sand Harbor and flows 1.8 miles from Marlette Lake to Lake Tahoe. Including its large south tributary, the total channel length is approximately 3.6 miles. Above State Route 28, the stream flows from Marlette Reservoir, which contains a dam that has been previously washed out. In a survey completed by Nevada Division of Wildlife (NDOW) in 1982, it was noted that some natural barriers exist in the channel and there is some noticeable bank erosion along sections of the creek. A USGS weir and gauging station measures outflow at Marlette Creek. The station has measured Marlette Creek flow rates since 1973, which have ranged from 0 to 63 cfs (TRPA and NDOW, 1982).

Secret Harbor Creek

Secret Harbor Creek and its tributaries equal an overall length of nearly 7.5 miles. The main stream channel is approximately 2 miles and has a natural barrier near its mouth. The watershed covers an area of 2,710 acres and produces approximately 4,380 acre-feet of water per year. 1,400 acre-feet becomes surface runoff from an annual average of 19.4 inches of precipitation. There are several other drainages that reach Lake Tahoe from this watershed. Just north of the Secret Harbor drainage and west of North Canyon is a small ephemeral pond. The pond forms seasonally in a drainage basin with no inlet or outlet. It covers less than a half surface acre and probably contributes to sub-surface flows into Secret Harbor (TRPA and NDOW, 1982).

Contrary to current USGS mapping, the 1.5-mile upper North Canyon watershed is currently, and was historically, part of the Secret Harbor watershed. This southeastern tributary to Secret Harbor Creek drains from Snow Valley Peak at over 9,000 feet, down through the upper reaches of North Canyon, and through the Secret Harbor drainage to Lake Tahoe. Approximately in 1866, a diversion ditch was constructed to increase the flows of lower North Canyon Creek for the irrigation of Spooner Meadow and log fluming activities. Since the mid-1900's, a divide has built up and put the flows of upper North Canyon back into its natural drainage – Secret Harbor Creek. The North Canyon Watershed Stream Assessment (2002) indicates that the stabilization of this divide should be a top priority for the health of adjacent water systems (figure 3).



Figure 3. The lowest point between the Secret Harbor watershed and the North Canyon watershed is between the photographer and the road.

Slaughterhouse Canyon/North Canyon Creek

The Slaughterhouse Canyon watershed is 3,180 acres and includes the park sub-watersheds of Lower North Canyon (1.4 square miles), Spooner (1.2 square miles), and North Canyon Creek

below State Route 28 (0.6 square miles). Slaughterhouse Creek enters Lake Tahoe at Glenbrook Bay. Most of the stream channel passes through upper and lower Prey Meadow. It receives constant flows from (lower) North Canyon Creek and Spooner Reservoir (when flows are allowed from the dam). During dry years, stream flows above the confluence of North Canyon Creek can run dry. The watershed produces 5,160 acre-feet of water annually and surface water accounts for 1,670 acre-feet. Slaughterhouse receives an annual precipitation total of 19.5 inches.

North Canyon Creek originates at springs and seeps just below the Secret Harbor drainage. It is probable that sub-surface flows still contribute to North Canyon Creek from the upper reaches of North Canyon or that particular tributary of the Secret Harbor Creek. The watershed is typically made up of 20 -40% slopes and meadows of 2 -5%. The stream channel passes through several meadow systems, most notably Upper and Lower Spooner Meadow. According to TRPA, North Canyon Creek has been found to have excellent water quality. At its headwaters is a deeply eroded gully, greater than 20 vertical feet, often referred to as the "grand canyon". The stream channel in the bottom of the gully has widened and stabilized although the sides are poorly vegetated leading to easily eroded top edges. The stream passes through several culverts under the North Canvon road. Lower in the watershed, North Canvon Creek passes through two additional culverts; one under Hwy 28 and one parallel to the highway on the upstream side. According to recent studies, the majority of the lower North Canyon stream channel is in proper functioning condition. It is predominantly well vegetated and stable. The channel shows evidence of past instability and subsequent healing under the reduced flow conditions that currently prevail. However, several small headcuts throughout the channel present potential risks for degradation of the meadows lower in the watershed. Bankfull stream discharges have recently been calculated at 10 –12 cfs. The upper portion of Spooner Meadow in North Canyon is currently in a xeric state. This may be in part due to the historic re-alignment of the natural channel into man-made irrigation ditches for past grazing activities. This could, in turn, be responsible for an un-natural lowering of the water table. A stream channel restoration project is currently underway to benefit the health of this portion of the meadow ecosystem.



Cave Rock

The 1,040-acre Cave Rock sub-watershed of Lake Tahoe includes the 3.2-acre Cave Rock park management unit of Lake Tahoe Nevada State Park and a subdivision located primarily above US Highway 50. This watershed has many drainages, of which 3 are somewhat significant although remain unnamed. It produces 1,740 acre-feet of water per year from 20 inches of annual precipitation. Six hundred ten acre-feet of this water is in the form of surface runoff annually. The Cave Rock watershed is bounded by two major Tahoe stream systems, Logan House Creek to the north and Lincoln Creek to the south (TRPA and NDOW, 1982).



Edgewood Creek

The Edgewood Creek watershed is approximately 6.6 square miles or 4,224 acres and produces over 9,350 acre-feet of water from 30 inches of rainfall annually. Approximately 5,450 acre-feet of water reach the mouth as surface runoff. Runoff processes in the watershed are dampened by the fact that a majority (over 90%) of the geology and soils present consist of highly porous decomposed granite. Streamflow in the summer months of July, August, and September (2002) typically range between 0.2 and 1.0 cfs. Flows appear persistent, even in drought years. The eight-year average for flows at the USGS Stateline gauging station (6,280 ft.) is 5.4 cfs (1993-2000). The watershed lies predominantly within Douglas County, Nevada, with a small upper portion within California. The land within the watershed has a variety of uses including the Stateline casino area, Edgewood Golf Course, Heavenly Ski Resort, residential neighborhoods and state / federal land. The Van Sickle unit of the park has a large portion of the southern watershed within its boundaries. The main stem of Edgewood Creek consists of 5.5 miles of stream channel. An additional 8.5 miles of perennial and 37 miles of intermittent and ephemeral drainages occur within the watershed. Approximately 1.2 miles of the two main southern tributaries are located within Van Sickle boundaries. Several impoundments, ponds, and diversions are located within the lower watershed. The impoundments and ponds are located up and downstream of Highway 50 and on the Edgewood Creek Golf Course.

Water quality data for the creek indicates that it is impaired with regard to both sediment and nutrients. In particular, the creek has an excessive load of bio-available iron and is on the Nevada List of Impaired Water Bodies due to continually elevated levels of total iron. Although much of the watershed was disturbed by historic roads and logging, most of the channel has stabilized. The channel in the lower portion of the watershed, though not owned or managed by NDSP, has been extensively modified by human activities. The majority of riparian vegetation, with the exception of heavily developed areas, is dense, thriving, and intact with reproduction occurring in numerous woody and herbaceous species. Overall, stream channels in the watershed are in relatively good condition in terms of channel stability. Excessive erosion in the watershed is primarily derived from upland sources such as roads and gullies. Some headcutting and areas of episodic downcutting and aggradation have been noted by studies. The most intact reaches of Edgewood Creek are located in the upper reaches of Van Sickle and the old Park Cattle Company.

It should be noted that some of these findings might be altered by the destructive results of the Gondola Fire of July 2002. The 673-acre fire burned upslope from a source location underneath the Heavenly Valley Ski Resort gondola across the southeastern reaches of the Edgewood Creek watershed. 249 acres burned across Nevada State Park property encompassing the lower portions of the Van Sickle unit. The park had the highest proportion of high intensity burn area at 42 out of 62 total acres. Fifty acres of the park was engulfed with medium intensity flames and 157 acres were low intensity. The majority of the fire (401 acres) was on USDA Forest Service property. Studies indicate that it may take 5 - 7 years for vegetation to recover. Rehabilitation to control erosion included the cross-slope felling of trees and straw wattle placement. Tree planting, seeding, fertilizing, and mulching occurred in the spring of 2003. Above average sediment loading from excessive erosion is a major concern. Additional revegetation activities and constant monitoring will be required in the future (Gondola Fire BAER Report, 2002).

Bijou Park

A very small portion of the Bijou Park watershed lies in the southwestern tip of the Van Sickle unit of LTNSP. A small, unnamed drainage passes into and out of the park boundary along the Nevada – California state line. Approximately ½ mile of this stream channel lies within the park.

Marlette Lake



Marlette Lake, actually a natural pond and watershed basin made into a reservoir, is found in the backcountry of LTNSP at the northern end of North Canyon and approximately 1.5 miles east of the park's Lake Tahoe shore. The Marlette Lake drainage basin is roughly three miles long, 1.2 miles wide, and comprises about 1,860 acres. The surface area of the lake itself is 381 acres. The basin has a minimum elevation of 7,823 feet at lake level and a maximum elevation of 9,214 feet (Snow Valley Peak). Marlette Lake has a maximum depth of 44 feet and has held between 10,970

(1976, minimum) and 12,320 (1986, maximum) acre-feet of water. The lake currently has 11,940 acre-feet (most recent value, 04/2003, USGS). The lake's capacity at the spillway is 11,780 acrefeet at an elevation of 7,838 feet. In addition to snowmelt, there are 7 small inlet streams around Marlette Lake and one outlet, Marlette Creek. The Nevada Division of Forestry (NDF) measured feeder stream flows in 1976. The greatest average flow was in Sheen Creek at .38 cfs. Coli Creek had the 2nd highest flow at .27 cfs with Trelease Creek flows at 0.24 cfs. Other creeks, such as Dieringer, Frantz, Hilts, and Sumner, had average flows of 0.17 cfs and have a tendency to dry up later in the year. Since the 1976 season was considered a dry year, it was estimated that during normal water years flows may be 2 –5 times higher. It has been reported that Coli Creek contributes more phosphate and sediment into Marlette than any other stream.

Originally known as Goodwin Lake, Summit Lake, and sometimes Rolla Lake (mid 1800's), it was a shallow ephemeral pond until the Elliot brothers constructed a primitive dam at the outlet of a broad glaciated basin. This was initiated in order to supply water to their Clear Creek flume in the mid to late 1860's. General Land Office (GLO) plat maps from 1861 to 1865 depict a small body of water in the northwest end of the basin now occupied by Marlette Lake (Far Western Archaeological study 2001). Marlette was named in the 1860's after Seneca Hunt Marlette, a surveyor general of California. In 1873, a larger dirt-fill and stone dam was erected by the Virginia Water Company (VWC). The VWC dam was 26 feet high, created a depth of 19.4 feet, and held 3,400 acre-feet of water. Under agreement with the Carson Tahoe Lumber and Flume Company (CTLFC), this water was originally used for transporting timber to lumber mills south of Carson City via Spooner Summit. In 1876, the Virginia and Gold Hill Water Company (VGHWC) increased the dam to a height of 37 feet in order to maintain a more reliable source of water for the Comstock Mining District of Virginia (City). This increased the depth of the lake to 29.4 ft. with a capacity of 6,100 acre-feet. A 4.5-mile box flume was constructed to transport water to the west portal of a 3,994-foot tunnel through the Carson Range as part of the Comstock's Marlette Water System. Marlette water was added to the yield of the North Flume, above Incline, that joined flows from Hobart Reservoir and Franktown Creek outside the basin. Water of the VGHWC was further transported to the mines of the Comstock through a complex system of flumes and pressure pipes. At its peak, 46 miles of flumes and 21 miles of pipe distributed 4, 200,000 gallons of water daily to the towns of the Comstock Lode. The Marlette Water System fell into disrepair after a collapse of the tunnel in 1957 but continued to produce water through seepage from the east portal. The Curtis Wright Corporation purchased the system that same year and the dam at Marlette was raised to its final height of 45 feet in 1959. The spillway outlet has a maximum capacity of 600 cfs at a water surface elevation of four feet above the flowline of the spillway. Curtis Wright and their subsidiary, the Marlette Water Company, attempted several business ventures with little success. After replacing the Marlette Flume with aluminum pipe and unsuccessfully attempting to open the tunnel, they sold the land encompassing the Marlette watershed and water system to the State of Nevada in 1963.

The Nevada Department of Wildlife (NDOW) conducted studies of water characteristics in 1975 and 1976 and found that the shallowness of the lake and wind action tended to discourage the formation of any long lasting thermocline (temperature variance in stratified waters). The largest temperature difference was 10 degrees F in August with a range of 54 to 64 degrees F. Up to three feet of ice can cover the lake from mid November to April with an average thickness of 13 inches. The lake has a distinct brownish coloration probably due to tannins released from decaying organic material. Secchi disc readings averaged 12.35 feet from October through September that year. The pH of the lake averaged 7.4 and no above normal or significant levels of chemicals detrimental to aquatic life was noted during NDOW's investigation. Oxygen levels occasionally fell below 5 ppm, but these readings were usually associated with the bottom. The upper water columns were found to have adequate oxygen levels to support fish populations. The lake was rich with nutrients, the zooplankton population extensive, and the numbers of phytoplankton and aquatic insects were much larger than expected. Invertebrates included aquatic oligochaetes, diptera larvae, midge larvae, snails, caddisfly larvae, damselfly nymphs, scuds, clams, leeches, and beetles. Crayfish were also abundant throughout the lake. Aquatic vegetation showed the most vigor in the bays where tributary streams deposit nutrients and silt. The majority of the vegetation was found growing at a depth of 5-23 feet.

From 1991 - 1993, a water quality study was conducted which included Marlette Lake. The Tahoe Research Group undertook the study, entitled "Seasonal Nutrient Limitation at Four High Altitude, Shallow Reservoirs of the Tahoe Basin and Northern Nevada", for the Nevada Division of Environmental Protection (NDEP) and TRPA. This study revealed that Marlette Lake tended to stratify thermally both during the summer and under the ice in the winter. Stratification was never strong and appeared to break down in mid to late summer, allowing for an early mixing period. During periods of stratification and periods of apparent isothermy (constant temperatures), dissolved oxygen in the deepest zone of the water column was frequently low or depleted. Dissolved inorganic nitrogen and soluble reactive phosphorus was usually below 20 ug/L and 15 ug/L respectively. Marlette Lake is considered mesotrophic, occupying an intermediate level of nutrient concentration. Levels of Chlorophyll were somewhat elevated, at least in relation to Spooner Reservoir at 3.91 ug/L. Results also characterized Marlette as a nitrogen-limited and nitrogen/phosphorus co-limited system. The phytoplankton community was extensive and relatively diverse being somewhat dominated by nitrogen-fixing blue green algae. Ph was relatively constant at approximately 8.5 and the average secchi depth was 11.5 feet. Summer surface temperatures ranged from 60 to 63 °F.

TRPA has collected limited data on total nitrogen, total phosphorus, total iron, and turbidity at Marlette. A two-year Threshold Indicator Study is in progress with USGS. Results were expected in 2004 or 2005 (TRPA). Generally, the lake is considered to be in attainment for nitrogen and phosphorus.

Marlette is an important spawning lake for NDOW. Spawning the fish population of the lake actually began many years ago. Fish introductions began with brook trout, in 1877 by Captain J.B. Overton, Superintendent of the VGHWC. Water company managers hoped the fish would help combat an explosion of freshwater shrimp that were literally clogging the pipes that carried water from the lake to the mining boomtown of Virginia City. The introduction was a success, although screens had to be placed on all of the reservoir outlets, in flumes, and at holding tanks to keep fish out of the tap water. In the 1880s, the brook trout were so abundant that the water company began a fishery in the lake, selling the fish at market. The State of Nevada began collecting spawn from the system for the Carson City Hatchery from 1883 to 1930.

The Marlette Lake fishery slowed down in the 1940s and 1950s, though the trout continued to thrive. In the late 1950s and early 1960s, the lake was reserved for the fishing pleasure of visiting dignitaries. After moving to state ownership in 1963, NDOW began their fish-spawning program and prohibited fishing in the lake in order to protect the brood stock. They introduced Lahontan cutthroat trout to the lake and by 1965, 248,000 cutthroat trout had been released and over 18,000,000 eggs were taken from Marlette Lake by 1975. As fishery biologists worked with the Marlette Lake cutthroat, they learned that this strain was not well prepared for the saline waters and native fish competition of Nevada and Lahontan cutthroat stocking ended in 1987. NDOW decided to introduce and spawn a species that was more suitable for the lakes of the Tahoe basin and introduced Tahoe rainbow trout to the lake in 1984. As of 2002, over six million eggs have been harvested from broodstock in Marlette Lake. The Nevada Board of Wildlife Commissioners opened up the lake to public fishing as of July 15, 2006 as a catch and release fishery only.

Hobart Reservoir and Hobart Creek



Hobart Reservoir is a man-made impoundment located at 7,542 feet in the eastern portion of LTNSP in the Carson Range of the Sierra Nevada Mountains. The lake lies a few miles above Carson City with the nearest access from Lakeview road in Washoe Valley or Ash Canyon. The watershed for Hobart covers 1,630 acres. Two major streams feed the lake. Hobart Creek is 1.6 miles in length and enters from the south while the second stream is unnamed, 1 mile in length, and enters from the southeast. Both streams enter Hobart Lake through a marsh-type riparian area that

is inundated from active beaver dams, several of which are hundreds of feet long and 3 to 4 feet high. Besides these tributary streams, several small springs feed the reservoir from the southeast. In addition, water pumped from Marlette Lake enters Hobart Reservoir as part of the municipal Marlette Water System.

NDOW surveyed Hobart Reservoir and Hobart Creek, its main tributary, in 1979. At that time, the creek had a mean discharge of 0.7 cfs. The average width was 6.6 feet and 2.9 inches in depth. Hobart Creek's average stream gradient was 18% with a velocity of 1.6 feet per second. Stream banks were considered stable and in fair condition. The water was clear along its entire length. The waters of the creek and reservoir were not found to contain toxic levels of chemical compounds lethal to aquatic organisms, although Hobart is contaminated with heavy metal concentrations of iron above the limits set by the State of Nevada Water Supply Regulations for drinking water. Dissolved oxygen levels proved adequate to support fish, the lowest recorded reading being 3.9 ppm taken at 13 feet in January. Hobart Reservoir is entirely inundated with aquatic vegetation except the deepest portion adjacent to the dam. Plants vary in height from a few inches to over 10 feet. Aquatic invertebrates include snails, aquatic earthworms, mayfly nymphs, leeches, Diptera larvae, beetles, and clams. Hobart Reservoir has gradually lost storage capacity due to the natural processes of eutrophication. The reservoir and its stream system is a class B water under NAC 455A.125.

Named after Walter S. Hobart, owner of the Sierra Nevada Wood and Lumber Company, the reservoir was a part of the VGHWC water system supplying water to the Comstock. The reservoir and dam is managed by the Building and Grounds Division of the State of Nevada as part of the Marlette Water System, still in use today as a domestic water supply. The earth-fill dam was built in 1887. It is 350 feet long, 28 feet high, and has a spillway height of 22 feet. The spillway outlet has a maximum capacity of 1,600 cfs at a water surface elevation 6 feet above the flowline of the spillway. The dam was breached twice before by heavy winter snows and ice flows, once in 1910 and again in 1955. In 1957, the water system, including Hobart Reservoir, was sold to the Curtis Wright Corporation. They turned it over to their subsidiary, the Marlette Water Company. They pursued a defense contract to supply water for a missile-testing program in Storey County that never came to pass. In 1963, the reservoir and surrounding lands were

purchased by the State of Nevada to become part of the Marlette Hobart Backcountry Unit of LTNSP. The reservoir supports a good Brook and Rainbow Trout population and is a very popular fishery.

The stream below the dam is Franktown Creek. The reservoir covers approximately 10 surface acres, is about 22 feet deep, and stores 107 acre-feet or 35,000,000 gallons. The water available from the Hobart watershed is about 2,660 acre-feet during a normal water year. It has previously been proposed to increase the storage capacity of this area by building a dam to impound approximately 10,000 acre-feet. The new dam would be built either on the site of the present dam or at a new site ½ mile downstream. The site of the latter would require a dam 120 feet high. The current status of this proposal is unknown.

Spooner Reservoir

Spooner Reservoir is a shallow body of water approximately 11 miles west of Carson City at the junction of Highways 28 and 50. It rests at an elevation of 6,983 feet in the Carson Range of the Sierra Nevada Mountains. Spooner Lake encompasses an area about ³/₄ of a mile in diameter in Upper Spooner Meadow and is part of a small (1.2 square mile) catchment that contributes to downstream flow to the Slaughterhouse drainage basin. It has been estimated by NDOW that approximately 362 acre-feet of water is available to the reservoir from its primary watershed although this calculation may not have taken all sources into consideration. Several small streams drain into this basin, most of which carry water seasonally. At least two spring-fed rivulets enter the basin from the south end. For the most part, springs, seeps, and snowmelt feed the reservoir. Most historic sources indicate that prior to the construction of the reservoir the basin formed a meadow rather than a lake but probably did support a small seasonal pond (Far Western Archaeological Study 2002). A new dam was constructed by NDSP at the northwest corner of the lake in 1981-82. The reservoir covers 100 surface acres and stores approximately 1,580 acre-feet of water. At maximum elevation it is approximately 23 feet deep. After the new dam was built, NDOW entered into an agreement with the Washoe Tribe to maintain a certain reservoir level, somewhat less than capacity, in order to prevent the submerging of the "grinding stones". NDSP maintains this level with spring releases into the meadow. The grinding stones, located on the north side of the lake, are a recognized archaeological site that represents the extensive pre-historic presence of the Washoe Indians. Spooner was used by the tribe as a summer hunting and gathering area as well as for religious purposes. Winters were typically spent below in Washoe Valley.

From 1873 to 1896, the Marlette Lake to Spooner Summit V-Flume was in operation that supplied water to two mills in lower Spooner Meadow and other fluming operations at Spooner Summit. In the 1860's, Michele E. Spooner owned and operated a small milling operation in the area. Spooner Lake began to form as a reservoir in 1869 when Louis Spooner constructed two ditches from North Canyon Creek to begin irrigating Spooner Meadow. At this time, a 6-foot high dam was built to impound water in the upper Spooner Meadow. It is likely though that the CTLFC built the more elaborate water impounding works above and below Spooner's ditches, perhaps after 1883, when the Virginia Water Company cut off the Marlette Lake water supply to Spooner Summit. At this point it is likely that Spooner Reservoir was a small millpond used in the extensive water and logging operations of the area (Spooner Summit's "Summit Camp"). Appendix F Map 3 from the Far Western Archaeological Study (2002), showing water usage

between 1862 and 1896, indicates a "20 acre reservoir" in Spooner Lake's present location. In 1920, Charles Fulstone leased Spooner Meadow from CTLFC and, at this time, the reservoir became known as Fulstone Reservoir. A 1927 map from the 2002 Far Western study shows Fulstone Reservoir at 69.81 acres. In the 1940's, a larger dam was built that transformed the existing irrigation pond to Spooner Reservoir. The lake and dam do not show up on Forest Service maps until 1949 when the dam, spillway, and culverts are portrayed. George Whittel acquired the property in the early 1930's along with most of the east shore of Lake Tahoe.

In 1970, the State of Nevada purchased the property that included 1,140 acres around Spooner. Spooner Reservoir, a management unit of LTNSP, was officially opened in 1981. Stocked by NDOW, it was once the only catch and release lake in the state of Nevada. In 2006, a limit was set for Spooner Lake by the Nevada Wildlife Commission at five trout. Lahontan cutthroat trout, rainbow trout, brown trout, bowcut trout (rainbow X cutthroat), brook trout and tiger trout (brown X brook hybrid) have been stocked in the past five years. Lahontan tui



chub, a native fish in the minnow family, however, dominates the lake. NDOW has documented winter fish kills due to low dissolved oxygen levels. In response to this, they have made past attempts with an aeration device to keep the ice open to prevent complete winter kill. This practice met with limited success and has been most recently discontinued. In 1995, their data showed 716 anglers fished Spooner 4,174 days and took 33,104 fish. The five-year average revealed 672 anglers fishing 3,644 days and capturing 16, 568 fish. Oxygen levels in the lake are a limiting factor as a habitat and are closely monitored by NDOW. Summer levels are adequate, typically at 4-5 ppm or as high as 13 ppm. Winter oxygen levels become a problem, which can be as low as 1 ppm, and can be responsible for most fish winterkill episodes.

In 1991 – 1993, a water quality study, including Spooner Lake, was conducted (the same study mentioned previously for Marlette Lake). Again, the UC-Davis Tahoe Research Group conducted this study on behalf of NDEP and TRPA. Results were somewhat similar to those of Marlette Lake although in certain ways they are very different lakes. Though Spooner Reservoir is shallow, it did tend to thermally stratify under the ice and at times during the summer. Like Marlette, dissolved oxygen concentrations were generally deficient or depleted, even during periods when the lake was isothermal. Dissolved inorganic nitrogen was also relatively low; usually between 10-20 ug/L. Spooner is characterized as being a N-limited or N-P co-limited system. Chlorophyll concentrations were routinely low, summer values ranging from 0.6-1.4 ug/L. The phytoplankton community was fairly substantial with dominance from green algae. Spooner does not support large communities of nitrogen-fixing algae. It is classified as being a meso-oligotrophic water body (middle to low nutrient level rating). The average value for PH varied between 8 and 9.7. July water temperatures ranged from 67 at the surface and 64 at maximum depth. Secchi depths averaged 10.3 feet.

TRPA has collected limited data on total nitrogen, total phosphorus, total iron, and turbidity at Spooner. As part of TRPA's 2006 threshold evaluation, the US Geological Survey (USGS) completed an analysis of data from 2002 and 2003 to determine the need to establish water quality standards and determine nutrient concentrations of several lakes in the Tahoe basin, including Spooner and Marlette Lakes (Lico 2004). A summary of nutrient concentrations for these lakes from this time period is provided in Appendix G. Generally, both lakes are considered to be in attainment for nitrogen and phosphorus and do not show decreases in water quality relative to data collected by TRPA from 1991 – 1994.

Twin Lakes



Twin Lakes are located in a high drainage basin in the northwest section of the Marlette Hobart Backcountry. It is bounded by the peak-studded ridge of the Lake Tahoe basin to the west, an 8,706 ft. peak to the south, and other somewhat lesser peaks to the north. This basin is actually made up of two sub-basins that account for the existence of two separate lakes. At high water resulting from a heavy precipitation event, it is possible that Twin Lakes become one although this rarely happens. In such a case, drainage would be to the east into the watershed of Franktown Creek and the

Marlette Water System. The lakes are ephemeral in nature and often go dry later in the summer season. They exemplify the process of eutrophication, rich in nutrients and deficient in oxygen. Twin Lakes are heavily vegetated on the bottom with water loving plants and surrounded by meadow grasses. It is unknown if any lake survey or water quality data exists at this time.

Franktown Creek

Franktown Creek is found in the northeast section of the Marlette-Hobart Backcountry, originating at an elevation of 7,542 feet. Its main headwaters flow from Hobart Reservoir. In addition, 3 main tributaries enter from the East Slope drainage area of the Marlette Water System before the stream exits park property to the north. The stream channel continues through Little Valley, picking up several more small tributaries, before draining into the northwest end of (Big) Washoe Lake. A diversion ditch from Upper Price Lake, Ophir Creek, enters Franktown in its most northern reach. Headwater flows are part of the Marlette Lake Water System. The overall creek length is 14.2 miles including its main tributaries. Approximately 6.3 miles of this length resides within park boundaries. Most stream reaches run through a typical pine forest setting although portions of the creek in Little Valley are surrounded by high mountain meadow. A USGS gauging station at the Red House Diversion (7,380 ft.) measured the 25-year average streamflow at 3.64 cfs (1976 – 2000). USGS flow rates at Franktown in Washoe Valley (5,200 ft.) were averaged for 1953 and 1954 at 12 cfs. Franktown Creek is a class B water under NAC445A.125.

A stream survey was completed by NDOW in 1978 and 1979. Some of the results are as follows:

- Average stream width 8.5 ft.
- Average stream depth 4.8 inches
- Average stream velocity 2.4 ft. / second
- Average discharge rate 3.5 cubic ft. / second
- Average water temperature 46 F. (maximum 54 F, minimum 30 F)
- Turbidity slightly cloudy in certain areas (probably due to spring runoff), most other areas appeared clear.
- Average stream shading from cover 44%.
- Stream bank rating 69% are stable, some evidence of erosion.
- Average stream gradient 5%
- Channel stability fair

Lewers Creek

Lewers Creek is found just southeast of Franktown Creek in the park and drains into the meadows of southwestern Washoe Valley. Probably due to lower annual flows, possibly intermittent, it does not appear to drain surface waters into Washoe Lake. According to USGS maps, the stream has a 2.3 mile overall length with approximately 1 mile residing in the park. Lewers Creek passes under the Musgrove Canyon road just as it enters park boundaries. No additional stream survey data is available.

Musgrove Creek

Musgrove Creek flows through the northwestern portion of the Marlette-Hobart Backcountry and enters into the south meadows of Washoe Lake. Its headwaters originate at 7,160 feet in elevation from the slopes of the Sierra Mountains above Washoe Valley. The main stream channel passes through Big Canyon and is sometimes known as Big Canyon Creek. Its overall stream channel is 8.15 miles. Approximately 1.9 miles are in the park, mostly the 4 main tributaries from east-side Sierra slopes. In Washoe Valley, water is diverted for irrigation and flows into the lake become intermittent.

Surveys completed by NDOW in1979 describe the following stream characteristics:

- Average stream width 2.6 ft.
- Average stream depth 1.5 inches
- Average stream velocity 0.9 ft. / second
- Average discharge rate 0.2 cubic ft. / second
- Average water temperature 52 F. (maximum 53 F, minimum 51F)

- Turbidity clear
- Average stream shading from cover 77%.
- Stream bank rating 80% are stable, very little evidence of erosion.
- Average stream gradient 16%
- Channel stability fair

McEwen Creek

McEwen Creek is located in the Lakeview portion of the backcountry and is the next major drainage to the south of Musgrove Creek. The Lakeview road follows much of this stream channel as it enters the park from Washoe Valley. The headwaters of this creek originate at over 7,700 feet in elevation just east of Hobart Lake. It meanders approximately 5 miles from the park, through Washoe Valley, and draining ultimately into the southeastern end of Washoe Lake. There is 1 main tributary branching off to the south toward the water tanks above Lakeview approximately ½ mile. About 1.7 miles of these upper reaches are within LTNSP boundaries. Much of the upper segment of McEwen Creek follows Sawmill Canyon and was historically known as Sawmill Creek. The lower drainage passes under Hwy 395 and the through the south wetlands of Washoe Lake State Park along East Lake Blvd.

Surveys completed by NDOW in1979 describe the following stream characteristics:

- Average stream width − 2.3 ft.
- Average stream depth 1.7 inches
- Average stream velocity 1.7 ft. / second
- Average discharge rate 0.2 cubic ft. / second
- Average water temperature 54 F. (maximum 56 F, minimum 51F)
- Turbidity clear
- Average stream shading from cover 96%.
- Stream bank rating 53% are stable, some limited evidence of erosion.
- Average stream gradient 19%
- Channel stability fair

Adjacent Watersheds

It should be noted that additional stream drainages have their headwaters adjacent to or within proximity of LTNSP. Due to their locations, park management activities and policies have the potential for impact on these water systems. These streams are the Vicee Canyon drainage, Ash Canyon Creek, Kings Canyon Creek, and Clear Creek. These creeks lie for the most part on Forest Service property under the management of the Carson Ranger District but also occupy some county and private property. They basically drain off the east slopes of the Sierra Nevada Range into the valley occupied by Carson City.

- Vicee Canyon holds approximately 2.9 miles of drainage originating from points just to the south of the "tanks" of the Marlette Water System. In addition, 0.8 miles of aqueduct from this system enters this canyon.
- Ash Canyon Creek drains approximately 2.5 cfs of water originating from the eastern slopes of Snow Valley Peak (NDOW, 1979). Its overall channel length is over 5 miles. Ash Canyon is a class A water under NAC 445A.124.
- Kings Canyon Creek drains slopes above Carson City just to the south of Ash Canyon. The upper reaches begin as 2 main tributaries with smaller branches and springs to total an overall length of over 10 miles. It has average flows of 1.2 cfs (NDOW, 1979). Kings Canyon too is a class A water under NAC 445A.124.
- Clear Creek is a major stream system with at least 6 main tributaries. Its originating channels flow along the southeastern boundary of the Marlette-Hobart Backcountry and just below (south) of Snow Valley Peak. One of the tributaries appears to be within park boundaries northeast of Spooner Lake. Its overall channel length is approximately 15 miles as it drains down through Carson City and into the Carson River. Average flows are 2.0 cfs (NDOW, 1979). Clear Creek is also a class A under NAC 445A.124. Some portions of this stream system are class B under NAC 455A.125.

Marlette Lake Water System

The historic Marlette Lake Water System is still in use today and supplies water to Virginia City, Silver City, Gold Hill, Lake view estates in Washoe Valley, the state Capitol Complex, and Carson City (during peak use). It is made up of water from the Marlette Lake Basin, East Slope Basin including seepage from the Incline Tunnel, and the Hobart Creek Basin including the upper reaches of Franktown Creek. The annual safe yields for these basins are summarized as follows:

- 1. Marlette Lake Basin 2,800 acre-feet
- 2. East Slope Basin 1,500 acre-feet
- 3. Hobart Creek Basin 2,000 acre-feet

The State of Nevada has water rights to the top 3 feet of the reservoir, or up to 3,000 acre feet annually. A total of 55, 855, 000 gallons were pumped from Marlette Lake in 1994. The average annual yield has been estimated at 1,866 acre-feet or 62% of the total water right (Brown and Caldwell, 2000).

A diesel pump was previously used to push Marlette water over the Carson Range and into an overland drainage above Hobart Lake. The state has utilized temporary pumps since 1966 from a cove on the east side of the lake using an 8 inch diameter surface pipeline placed east / northeast from Marlette to the Hobart Lake drainage basin. Water quality is an issue with this municipal water supply since open reservoirs and stream channels are such a large part of the system and allow potential contamination by animal fecal material and wind blown solids. Prior to recent upgrades to the system, pumping from Marlette Lake to Hobart Reservoir required an engine

driven pump, oil tank, associated plumbing, an oil service truck and a caretaker to provide periodic maintenance. The pump was used generally during the summer season of drier years to augment the rest of the water system and operation of the pump contributed a significant amount of noise pollution to the area.

Eight and 12-inch pipelines have replaced flumes along the east face. There are at least six spring collectors located between the east portal of the tunnel and the Red House diversion structure. The east slope drainage is made up of approximately 1,540 acres. The Red House diversion, a concrete stepped weir and control valve assembly, joins flows from the east face with that of the Hobart Creek drainage. In addition to the waters of the Hobart Reservoir watershed, approximately 480 acres of the upper Franktown Creek watershed drains into the Red House diversion. An 18-inch pipe carries this water to storage tanks above Lakeview in Washoe Valley for further distribution to Virginia City and Carson City. At this point, Virginia City, Gold Hill, and Silver City water is diverted northeast into an inverted siphon while Carson City and State of Nevada water is diverted southeast into the Vicee Canyon drainage above Carson.

In 2008, Buildings and Grounds (B&G) initiated upgrades to the system from the temporary pumping station to a permanent facility for public safety purposes. The upgrades included:

- a new pump, transformer, controls and intake at Marlette Lake;
- a generator building housing a natural gas-driven electric generator located southeast of Marlette saddle:
- new two-inch and four-inch natural gas service lines and related appurtenances to provide natural gas for the generator;
- two, four-inch conduits running from the pump to generator
- 7,390 linear feet of 12-inch pipeline from Marlette Lake to Hobart Creek (ductile iron pressure pipe and C-900 PVC pipe);
- a new 8 foot x 8 foot CMU structure to house a remote telemetry unit and water control valve equipment at the Hobart Lake Dam to replace the previous CMU structure which covered the existing water control gate valve. The remote telemetry unit will transmit lake level data at Hobart Lake to the Marlette generator station;
- new building at the Red House diversion, with controls powered by solar and LPG/natural gas generator;
- replacement of manual control valve at Red House with automatic valve controlled through the Marlette System SCADA (Supervisory Controls and Data Access) to allow year-round control of flow remotely from Hobart Reservoir into the collection system.
- Tie-in of Marlette generator and pump telemetry into Marlette SCADA; and,
- approximately 2.8 miles of 4" PE gas line.

Other than the new 12-inch pipeline mentioned above, the pipelines of the system are reported to be in fair condition, although spot repairs are continually needed. Present water needs, except for drought conditions, appear to be met using Hobart Lake, the collection of spring water along the

east face of the flume route and seepage from the tunnel. Quantities of inadequately treated water enter the distribution system. Marlette-Hobart waters tend to have poor tastes and odors that are generally from decay of organic materials and algae. According to a 1978 report, the water of the system is contaminated with concentrations of iron, manganese, and copper above the limits set by the State of Nevada Water Supply Regulations for sage drinking water. A state-owned water treatment plant in Ash Canyon was taken out of service in 1999. The state has reached an agreement with Carson City to provide treatment for the water from the system that is used by the Capitol Complex and the city. Water that flows to Virginia City and the surrounding areas is delivered to the Virginia City Water Company for treatment and distribution (Marlette Lake Water System Preliminary Engineering Report 2001).

Scenic

The park contains many natural features that are of high scenic value to visitors. These include mountain peaks (Snow Valley Peak, Marlette Peak), meadows (Spooner Meadow), aspen groves, prominent rock outcrops, lakes, and shoreline along Lake Tahoe. Additionally, there are numerous vistas along trails within the park, including several points in Van Sickle and the Marlette Lake Overlook.

TRPA completed a Scenic Resource Inventory of the Lake Tahoe Basin in 1982 in support of the development of scenic thresholds for roads and shorelines. Scenic quality was evaluated in terms of the view of backdrop landscape from the skyline, character of shoreline, and points of interest. The Cave Rock, Sand Harbor, and Spooner Lake management units fall within identified scenic units of the inventory.

Cave Rock is located within Roadway Unit 29 and Shoreline Unit 26. Roadway Unit 28 is described as having a high overall scenic quality and a scenic rating of 3. Shoreline Unit 26 has an overall moderate scenic quality and a rating of 2, with Cave Rock listed as a prominent topographic and scenic feature.

Sand Harbor is located within Roadway Unit 26 and Shoreline Unit 24. Roadway Unit 26 is described as having an exceptionally high overall scenic quality and a scenic rating of 3+. Shoreline Unit 24 has an overall high scenic quality and a rating of 3, noting that Sand Harbor is a prominent scenic feature within both roadway and shoreline units.

Spooner Lake is located within Roadway Unit 28. Roadway Unit 28 is described as having a moderate overall scenic quality and a scenic rating of 2, with Spooner Lake noted as a providing scenic vistas.

Biotic

Biotic natural resources are comprised of the existing vegetation, wildlife, and fisheries within the park and the dynamic processes that shape their habitats. As described more fully in the General Management Plan, these resources include several special status species requiring particular care in their management, such as Tahoe Yellow Cress, American Bald Eagle, northern goshawk, mountain beaver, and Sierra Nevada Snowshoe hare. A listing of common and special status species found within the park is contained in Appendix C (Vegetation List) and Appendix F (Birds, Mammals, Fish, and Herptiles List).

Forest habitats of the Tahoe basin have been significantly impacted by human activity since European discovery in 1844, and to a lesser extent by Native Americans with fire prior to that. During the period from 1870 to 1890, many of the forests in Tahoe were clear-cut in order to be used as firewood, shoring for mines, and home construction in support of the Comstock mining operations in Virginia City. Fire, often considered the most important natural process in the forests, has been eliminated over the past hundred years in response to a nation-wide policy of aggressive fire suppression. As a result, today's forests are less structurally diverse, support fewer wildlife species, and are more prone to experience catastrophic wildfire and outbreaks of insects and disease. More recently, terrestrial and aquatic invasive species have been identified as significant threats to habitat due to displacement of other plant and animal species, increased rates of erosion, and undesirable characteristics that affect recreational uses.

Vegetation and Forest Resources

Vegetation in the park includes a number of different trees species, including white fir (Abies concolor), red fir (Abies magnifica), ponderosa pine (Pinus ponderosa), Jeffery pine (Pinus jeffreyi), sugar pine (Pinus lambertiana), western white pine (Pinus monticola) incense cedar (Calocedrus decurrens), lodgepole pine (Pinus contorta var. murrayana), and western juniper (juniperus occidentalis). Manzanita (Arctostaphylos spp.), huckleberry oak (Quercus vaccinifolia), bitterbrush (Purshia tridentata) and ceanothus (Ceanothus spp.) form the majority of the understory shrub components. The average age of dominants and co-dominants trees is approximately 90 years old, with ages ranging from 70 to 140 years. Riparian species, such as several species of willow (Salix spp.), creek alder (Alnus spp.), dogwood (Cornus spp.), and aspen (Populus tremeloides) inhabit wetter areas along lakes and streams. Dominant over-story species alteration has occurred, due mainly to Comstock logging and fire suppresssion, favoring a transition from pine to fir.

A park-wide vegetation map was derived from vegetation communities identified during field visits in 2006 and GIS using orthorectified 1-foot resolution aerial photography obtained from the Nevada Department of Transportation (2004) and from the 1-meter resolution IKONOS satellite imagery (2003). Dominant vegetation communities were determined by the position of the topmost canopy layer and coverage, consistent with *A Manual of California Vegetation*, noting that occasional conifers (white fir, Jeffrey pine, and sugar pine) may be found in all communities. Vegetation types, based on California Wildlife Habitat Relationships (CWHR) classification, found within the park are described below.

Aspen - Aspen groves are located in various locations adjacent to streams and wetland areas within the park. These areas are characterized by a canopy of quaking aspen (*Populus tremuloides*) and occur in two associations, Quaking Aspen/Mountain Pennyroyal and Quaking Aspen/California Corn lily. Aspen trees have deep root systems that allow them to grow in both wetland and adjacent upland areas. In some areas conifers, such as white fir and lodgepole pine, have invaded these stands. Occasionally, shrub layer species occurring within this community include several different species of willow as described in Montane Riparian (below). Ground-cover species within this area are typically a dense assemblage of herbs and grasses, including cow lily (*Veratrum californicum* var. *californicum*), horse tail (*Equisetum arvenses*), onion

(Allium sp.), Fendler's meadow rue (Thalictrum fendleri var. fendleri), and canarygrass (Phalaris sp.).

Barren – Does not contain vegetation, such as rock outcrops or bare soil.

Jeffrey Pine – Usually pure stands of trees where Jeffrey pine is the dominant species found in the upper tree layer. It occurs between subalpine conifer at higher elevations and pinyon-juniper or sagebrush at lower elevations and is commonly found on soils developed from granite and lava flows. Dominant understory shrub layer species include currant, snowbush, and greenleaf manzanita at higher elevations, and antelope bitterbrush, rabbitbrush, and sagebrush at lower elevations.

Juniper – Juniper habitats occur on virtually all exposures and slopes but are common on level to gently rolling topography. This vegetation type is characterized as woodlands of open to dense aggregations of junipers (California, Utah, or western) in the form of arborescent shrubs or small trees.

Lacustrine – Lacustrine habitats are inland depressions or dammed riverine channels containing standing water. They may vary from small ponds less than one hectare to large areas covering several square kilometers with depths that vary from a few centimeters to hundreds of meters. Typical lacustrine habitats include permanently flooded lakes and reservoirs

Lodgepole Pine – This type is generally found above red fir and below the other subalpine conifer habitats in cold pockets forming open stands of similarly sized specimens in association with few other species and with a sparse understory consisting of scattered shrubs and herbs, or a rich herbaceous layer at meadow margins.

Mixed Chaparral - Mixed chaparral is a structurally homogeneous brushland type dominated by shrubs. Shrub height and crown cover vary considerably with age since last burn, precipitation regime, aspect, and soil type. Dominant species include huckleberry oak and several species of ceanothus and manzanita. Individual sites may support pure stands of these shrubs or diverse mixtures of several species.

Montane Chaparral - Chaparral vegetation is found on exposed granitic soils with rock outcrops and contains sparse conifer coverage. Within the park, this vegetation community is dominated by low growing oaks (*Quercus vaccinifolia*) ranging from four to eight feet in height, and shrub species, primarily bitterbrush (*Purshia tridentata*). This community is fire adapted and typically species sprout back following a fire.



Figure 4. Montane chapparal, Jeffrey pine/Huckleberry oak association.

Montane Riparian – This community is characterized by different species of willow including Eastwood willow (*S. eastwoodiae*), Lemmon's willow (*S. lemmonii*), Scouler's willow (*S. scouleriana*), and narrow leave willow (*S. exigua*). A diverse assemblage of herbaceous ground cover is present throughout this community, including cow lily (*Veratrum californicum* var. *californicum*), horse tail (*Equisetum arvenses*), onion (*Allium* sp.), and meadow rue (*Thalictrum fendleri*). Montane Riparian areas are found adjacent to and within streams and adjacent wetlands.

Perennial Grass – Perennial Grassland habitat typically occurs on ridges and south-facing slopes, alternating with forest and scrub types. They are most often found on Mollisols and are dominated by perennial grass species such as redtop (*Agrostis gigantea*), silver hairgrass (*Aira caryophyllea*), sweet vernalgrass (*Anthoxanthum odoratum*), coast carex (*Carex obnupta*), orchardgrass (*Dactylis glomerata*), California oatgrass (*Danthonia californica*), Idaho fescue (*Festuca idahoensis*), red fescue (*Festuca rubra*), Douglas iris (*Iris douglasiana*), western bracken fern (*Pteridium aquilinum*) and red clover (*Trifoium pratense*).

Red Fir – Red fir habitats occur on frigid soils of the higher mountains areas. Small pockets of lodgepole pine also occur in wet sites scattered throughout large tracts of red fir. Mature red fir stands normally are monotypic, with very few other plant species in any layer. Heavy shade and a thick layer of duff tend to inhibit understory vegetation, especially in dense stands. Stand structure is typified by even-aged (established within 20-year span) groups of trees.

Sagebrush - This community is dominated by sagebrush (*Artemesia tridentata*) with associated species such as lupine (*Lupinus spp.*), bittercherry (*Prunus emarginata*), buckwheat (*Erioginum spp.*), and various grasses (e.g., *Poaceae spp.*). Some characteristics of this ground-cover assemblage are also present in the Sierran Mixed Conifer community where tree coverage and a relatively open canopy occur.



Figure 5. Sagebrush community, Red Fir/Sagebrush association.

Sierran Mixed Conifer – The Sierran mixed conifer habitat is an assemblage of conifer species that forms a multilayered forest. Dominant overstory species can include white fir, Jeffrey or ponderosa pine, sugar pine, and incense-cedar. Deerbrush, manzanita, chinquapin, bitter cherry, squawcarpet, mountain whitethorn, gooseberry, and Woods' rose are common shrub species in the understory.

Subalpine Mixed Conifer - These forests typically occupy extremely harsh environments on soils that are generally thin and of low quality coarse sand, gravel, volcanic debris, and rocks derived from decomposing parent material. Several species dominate canopies of this type, including mountain hemlock, western white pine, lodgepole pine, and whitebark pine.

Table 3. Amount of vegetation types in acres within Lake Tahoe Nevada State Park (derived from analysis of 2002 and 2003 IKONOS satellite imagery) by California Wildlife Habitat Relationship (CWHR) type.

Vegetation Type	Area (acres)	Vegetation Type	Area (acres)
Aspen	307	Montane Chaparral	2,024
Barren	202	Montane Riparian	319
Jeffrey Pine	6,430	Perennial Grass	212
Juniper	6	Red Fir	4,045
Lacustrine	616	Sagebrush	1,613
Lodgepole Pine	48	Sierran Mixed Conifer	2,095
Mixed Chaparral	318	Subalpine Conifer	109

<u>Late Successional/Old Growth Forests</u>

The importance of late successional/old growth (LSOG) forests has long been recognized. A number of wildlife species rely on or are associated with old growth forests, including spotted owl, golden-crowned kinglets, brown creepers, great gray owls, and mesocarnivores such as pine marten and fishers. Numerous publications have attempted to characterize, define, and make recommendations for management of LSOG forests, with the most recent and applicable being the Sierra Nevada Ecosystem Project (SNEP), Lake Tahoe Watershed Assessment, work completed by Barbour and Fites-Kaufmann, and the Sierra Nevada Forest Plan Amendment.

TRPA's 2001 Threshold Update made changes to the LSOG Goals and Policies to manage a certain percentage of forests in the Tahoe basin in three different zones (subalpine, upper montane, and montane) to move them towards exhibiting old growth characteristics, as defined by the US Forest Service. The target percentages basin-wide of old growth by zones are: subalpine, 61%; upper montane, 68%; and montane, 48%. Additionally, trees >30" dbh on western slopes and >24" dbh on eastern slopes may not be cut, unless a TRPA exception exists. The threshold also indicates that prescribed fire is the preferred management approach to maintain or attain old growth characteristics in a stand, but that thinning and timber harvesting are also acceptable.

Research suggests that historically 55% of the forests of the basin were in LSOG status, whereas only 5% qualify today. In regards to composition, LSOG stands today appear to have retained features characteristic of historic or surrogate forests, including similar overstory cover and tree densities. However, understory trees are much denser with a species composition that contains a higher level of dominance by white fir (1:1 pine:fir ratio historically, trending to 1:7 in the next 80 years). Barbour, et al. (2002) provide a quantifiable definition for LSOG stands in the Tahoe

basin that have been used in the Watershed Assessment and associated GIS mapping, as follows for a given hectare:

- 1) a minimum of 5 snags of >76 cm dbh, 10 living trees of >76 cm dbh or >295 yr of age, and 25 living trees >40 cm dbh or >180 yr old; and
- 2) a maximum of 400 understory + overstory trees for all forest types except white fir (625 understory + overstory trees for white fir stands) and 35% cover by shrubs + herbs.

Within LTNSP, old growth sites have only been identified and mapped on the Tahoe basin side of the Marlette-Hobart Backcountry, based upon habitat suitability for American pine marten (*Martes americana*), an old growth obligate species. A map of these existing old growth stands is located in Appendix J. Additional areas of forest exhibiting old growth characteristics are located in the eastern portion of the backcountry and at Van Sickle, but have not been mapped yet.

Special Status Plant Species

Two special status plant species may be found within the park: Galena Creek rockcress (*Arabis rigidissima var. demota*) and Tahoe yellow cress (*Rorippa subumbellata*). Both plants are listed by TRPA as sensitive plants and are protected by regulation from disturbance.

Galena Creek rockcress - Galena Creek rockcress (*Arabis rigidissima var. demota*) is a small member of the mustard family that has been previously observed in the Marlette-Hobart Backcountry. It is currently a federal species of concern and its range appears to be restricted to the northern part of the Carson Range. Habitat for the plant includes sandy to rocky soils or outcrops derived from granitic or volcanic materials, mostly on moderate to steep northerly aspects. It is often found in drainage ways, near meadow edges, or in other moisture accumulating microsites, generally in dry openings in Abies - Pinus - Populus tremuloides associations. Three locations of the plant have been recorded in the park. Two of these are on the northern slopes of Marlette Peak, and the third is along the eastern slope of an unnamed peak between Marlette Peak and Hobart Reservoir.

Tahoe Yellow Cress (TYC) - Tahoe yellow cress (*Rorippa subumbellata*) is a low growing, yellow flowered member of the mustard family endemic to the beaches of Lake Tahoe in Nevada and California, and is found nowhere else in the world (Figure 6). The species is listed as endangered by the states of California and Nevada, is a candidate for federal endangered species list, and has been the focus of research and conservation efforts since the late 1970's. In 2002, a cooperative multi-agency conservation strategy was completed in an effort to conserve the species and develop sustainable management actions. The conservation strategy outlines the goals, objectives, and adaptive management process to meet the recovery needs of the species. Coupled with the strategy is a Memorandum of Understanding (MOU)/Conservation Agreement (CA), which provides a level of commitment by partner agencies (including NDSP) to protect and enhance the species. One population of TYC is located at the southern end of Hidden Beach, another can be found at the southern end of the beach at Cave Rock, and several plants have been found at both the eastern and western ends of the main beach at Sand Harbor.





Figure 6. Galena Creek rockcress (left) and Tahoe yellow cress (right).

In 2003, a pilot study was implemented to determine if outplanting nursery-grown plants could be successfully accomplished and used a potential mitigation and management tool. The TYC Technical Advisory Group selected four project sites, including Sand Harbor. The northern most portion of the beach north of the boat launch ramp was fenced off and a total of 297 container-grown TYC plants were installed along a grid transect perpendicular to the shore at prescribed intervals. An additional 281 plants were installed in 2004, followed by another study population of 180 plants at the southern end of Hidden Beach. Survivorship and mortality were then monitored throughout each season. By 2006, the plot at Hidden Beach had been damaged by high wave action and no plants remained at the Sand Harbor plot, so both enclosures were removed.

Exotics and Noxious Weeds

Invasive weeds pose a significant threat to wildlands throughout the central Sierra Nevada, including LTNSP. Invasive species (aquatic and terrestrial) are often introduced unintentionally, carried by natural elements or as contaminants in seed grain, packaging material, bilge or ballast waters, or attached to vehicles. Some have been unwittingly introduced for their perceived value, colorful flowers or ability to endure harsh growing conditions, such as Russian olive trees. Generally, these species can outcompete existing vegetation, spread rapidly and are difficult to control.

Invasive weed populations often decrease the biological diversity of an area, diminish wildlife habitat values, reduce forage production and usability, lessen agricultural production, and restrict recreational opportunities. Nevada Revised Statutes (NRS) 555.150 recognizes the potential problems arising from invasive weeds and requires the eradication of designated noxious weeds by all landowners. Within LTNSP, several invasive species have been recorded in North Canyon and near SR 28: Hoary Cress (*Cardaria draba*), Perennial Pepperweed (*Lepidium latifolium*), and Russian Knapweed (*Rhaponticum repens*). Comprehensive surveys for these occurrences and other invasive weed species in the backcountry were conducted in 2009 in cooperation with

the Nevada Tahoe Conservation District. No evidence of the historic occurrences was found; however, a population of Bull thistle (*Cirsium vulgare*) was observed in the vicinity of Spooner Lake and widespread occurrences of ox-eye daisy (*Leucanthemum vulgare*) were observed east of and throughout Spooner Meadow. Herbicide treatment for these species was initiated in 2010.

NDSP coordinates its efforts to prevent the spread of invasive species by participating in partnerships such as the Lake Tahoe Basin Weed Coordinating Group and developing an Invasive Weed Management Program to manage these species. The program will focus on the detection, mapping, control, and eradication of Groups 1 and 2 invasive species, as described below.

Group 1

Watch for, report, and eradicate immediately: These species are: 1) not currently found in the Lake Tahoe Basin OR 2) documented in areas adjacent to the basin and may move into the area OR 3) are small, eradicable populations. Aggressive treatment will be pursued when these species are found; educational programs will target early detection and reporting of these species.

- Canada thistle (*Cirsium arvense*)
- Diffuse knapweed (*Centaurea diffusa*)
- Hoary cress (*Cardaria draba*)
- Musk thistle (*Carduus nutans*)
- Rush skeletonweed (Chondrilla juncea)
- Russian knapweed (*Centaurea repens*)
- Scotch thistle (*Onopordum acanthium*)
- Squarrose knapweed (*Centaurea virgata Lam.* ssp. *squarrosa*)
- Sulfur cinquefoil (*Potentilla recta*)
- Teasel (*Dipsacus fullonum*)
- Yellow starthistle (i)

Group 2

Manage infestations with a goal of eradication: Encourage the management/control of populations of these species to prevent further spread in the Lake Tahoe Basin. Isolated populations will be targeted for eradication.

- Bull thistle (*Cirsium vulgare*)
- Dalmatian toadflax (*Linaria dalmatica*)
- Eurasian watermilfoil (*Myriophyllum spicatum*)
- Curlyleaf pondweed (*Potamogeton crispus*)
- Oxeye daisy (*Chrysanthemum leucanthemum*)
- Perennial pepperweed (*Lepidium latifolium*)
- Klamathweed (*Hypericum perforatum*)
- Scotch broom (*Cytisus scoparius*)
- Spotted knapweed (Centaurea biebersteinii)
- Yellow toadflax (*Linaria vulgaris*)

Fire

Fire is a natural part of the Sierran ecosystem that creates conditions for many plant species to regenerate. Fire plays a critical role in forest health and ecosystem function by reducing competition between species through thinning, recycling nutrients back into the soil, and creating a heterogeneous forest stand structure. Both plants and animals have evolved with and adapted to fire. Many animals low on the food chain increase in populations with the increased forage that results after a fire, which in turn benefits the predators that feed on them.

However, humans have disrupted the natural fire regime by altering fuel and vegetation conditions throughout many forests, resulting in an increased risk of catastrophic wildland fire and reduced forest ecosystem health. After more than a century of fire suppression and lack of management, large amounts of surface fuels have accumulated, continuous brush fields have increased in area and height, small trees have increased in the understory, and accumulations of large down material has increased that would have been reduced by fire in the past.

Taylor et al., have conducted several studies in the Tahoe Basin portion of the Carson Range related to historic forest structure and fire regimes. Their studies involve the use of undecomposed 120-year old cut stumps and live stems to quantitatively describe the structure and composition of the original forest and historic fire frequency in the basin. From these studies and others, it is estimated that a low-intensity surface fire burned on a given area of forest every 5-12 years in the lower elevations of the basin.

Insects and diseases

Common insects, parasitic plants, and diseases found in the park with management implications include dwarf mistletoe, several species of bark beetles, several types of cankers and rusts (e.g., western gall rust and stalactiform rust), and white pine blister rust. With the exception of white pine blister rust, these are native to Sierra Nevada forests and management is only necessary when they threaten park management goals. Often, several of these combine to result in tree mortality. For example, trees may be weakened by mistletoe infestations and attract bark beetles, and then finally die during a periodic drought cycle. Conversely, periodic drought may stress trees and cause them to be more susceptible to attacks from bark beetles or mistletoe infestations.

Dwarf mistletoe is a member of the parasitic plant genus *Arceuthobium*. It has an endophytic rootlike system that absorbs nutrients from within the host tree tissues. Its reproductive system is made of aerial shoots that rise from the host branch. The parasite causes branch proliferations that produce yellow needles called "witch's brooms" and can spread throughout the crown of a tree. As a result of the parasite, tree growth slows over time, eventually the crown dies and then the tree. Insects, particularly bark beetles, frequently invade heavily infected trees and kill them. Currently, only the Sand Harbor and lower portions of the Van Sickle management units are experiencing high levels of dwarf mistletoe infestation. Less prominent outbreaks have been noted in the areas around Tunnel Creek and Spooner Lake. A vegetation management plan for Sand Harbor that includes pruning of infected branches and removal of specific trees is under development as of 2008.

The pine engraver, *Ips pini* and fir engraver, *Scolytus ventralis*, are common and widely distributed bark beetles in North America. In the western United States, these beetles are a significant and frequent pest of pine and fir, respectively. They are not aggressive tree killers, even though large populations commonly infest logging slash, windthrown trees, or trees broken by wind or snow. When populations are low, *Ips* beetles may kill or top-kill widely scattered single trees or small groups usually numbering less than ten. Often these trees have been previously damaged by wind, snow, fire, or lightning. In outbreak years they may kill groups of 50 to more than 500 trees, especially in unthinned young stands. Bark beetle attacks are initiated by male beetles that bore through the outer bark into bark (phloem) and excavate a nuptial chamber several times the beetle's size. Pheromone attractants released by the male attract one to seven females, though typically two or three. After mating, each female constructs a tunnel or "egg gallery" in the phloem layer, slightly scoring the wood surface in the process. These galleries radiate from the nuptial chamber and frequently form a Y- or H-pattern aligned with the grain of the wood. Trees may eventually die as the transport of nutrients and water via the phloem is reduced. Within the park, the most significant bark beetle outbreaks have been in North Canyon and the Slaughterhouse Canyon areas.

The Mountain pine beetle (*Dendroctonus ponderosae*) primarily attacks lodgepole, ponderosa, sugar and white pines in Nevada, although pinyon pines are also a recorded host. The beetle spends most of its life under the bark of infested trees, making direct control of the beetle difficult. It has four development stages: egg, larvae, pupae and adult (beetle). The black or brown adult beetle, about the size of grain of rice, emerges from infested trees during the summer, normally from July to September, and attacks green trees. The attacking beetles carry fungus on their body which infects the trees. The fungus spreads through water-transporting vessels in the tree, preventing the flow of water to the foliage. The larvae eat the portion of the tree that transports the food manufactured by the leaves. These impacts, individually or combined, cause the trees death. A tree's defense against bark beetle attack is its ability to produce and exude resin at the point of attack, which "pitches out" the attacking beetle. When a weakened tree cannot produce sufficient resin to expel the beetle, the attack is successful. During epidemics, the number of attacking beetles can be so great, that even a healthy tree cannot repel them all, and it succumbs to the mass attack.

White pine blister rust is a non-native disease caused by the fungus *Cronartium ribicola*. This disease affects not only white pines, but sugar pines as well in the Tahoe basin. It is typically only a problem when currants or gooseberries (*Ribes spp.*) are growing nearby. Currants or gooseberries are alternate hosts and are needed to complete the life cycle of the disease organism. The fungus attacks the living bark of white pine, first breaking out in blisters, which exude a secretion, later forming larger, bright orange-colored dots. These orange dots are filled with fungal spores that are carried to the alternate host, where it develops during the summer. Spores from the currants re-infect healthy pines. The disease spreads rapidly up and down the tree, killing the branches and the main trunk. Within the park, tree mortality as a result of white pine blister rust has been observed at Van Sickle.

Wildlife and Fisheries

The eastern portion of the Tahoe Basin provides habitat for a number of wildlife species. Species commonly observed within the park include Steller's jay, mountain chickadee, dark eyed junco,

belted kingfisher, and mourning doves. Vegetation found in the park also provides habitat for small mammals such as ground squirrels, western gray squirrels, raccoons, and larger mammals such as coyotes, mule deer and black bears. Additionally, waterfowl species are frequently found in the lacustrine habitat of Lake Tahoe and other waterbodies, including mallards and common merganser. In addition to these more common species, several threatened, endangered, or sensitive species have the potential or have been reported within the park and are described more fully below. Sources of existing data included the recent (2006) TRPA GIS wildlife data layers, discussions and field visits with TRPA and NDOW wildlife staff, and the Nevada Natural Heritage Program records for the State of Nevada. A list of common and uncommon fish and wildlife species can be found in Appendix F.

Through the Environmental Improvement Program, NDOW has conducted annual monitoring of medium-sized forest carnivores within and adjacent to the park. Photographic bait stations were used to detect medium-sized forest carnivores and other species within the park, including fisher (Martes pennanti), long-tailed weasel (Mustela frenata), American marten (Martes americana), Sierra Nevada red fox (Vulpes vulpes), wolverine (Gulo gulo), northern flying squirrel (Glaucomys sabrinus), snowshoe hare (Lepus americanus), and mink (Mustela vison). These species are dependent on dense coniferous old growth forests and are considered to be indicators of forest health and ecosystem integrity. Late-successional/old growth forest habitat critical to these species is threatened by disturbance in the Lake Tahoe Basin, including historic logging and development that leave many areas altered or fragmented.

Fifty-one photographic bait stations were set up and monitored in 2007. Of the 51 sites, 18 were re-visited during the 2006 and 2007 winter season, representing 1,507 nights of survey. The greatest number of detections per camera station for the target species (in descending order) were: northern flying squirrel (28), long-tailed weasel (7), pine marten (4), bobcat (3) and mink (1). Northern flying squirrel was detected at 79.5 percent of sites (23 of 33), while the long-tailed weasel was recorded at 19.8 percent of sites (6 of 33). Others included, pine marten 13.2 percent (4 of 33), bobcat 9.9 percent (3 of 33) mink 3.3 percent, (1 of 33 sites). No detections of fisher (*Martes pennanti*), Sierra Nevada red fox (*Vulpes vulpes*) or wolverine (*Gulo gulo*) were made.

Surveys for mountain yellow-legged frog, California spotted owl, and northern goshawk were completed in 2002 - 2004 and in 2008 in the Van Sickle management unit as part of the permitting process for the development project. No detections were made of these species in 2008.

Special Status Fish and Wildlife Species

The **Northern goshawk** (*Accipiter gentilis*) is a protected species under the Nevada Revised Statutes, listed as a sensitive species by the USFS Lake Tahoe Basin Management Unit, and is a TRPA Special Interest Species. Goshawk nesting areas are typically 30 acres in size within a multi-layered mature forest stand that has a canopy with dense to open understory in drainages. Nest trees exhibit characteristics such as a crotch, fork, or several limbs on one side to support the platform nest. Within a home range there are typically two to four alternative nest areas during the breeding season, which is from late February to mid-August. Goshawk foraging habitat is typically about 5,400 acres and includes the transitional zones from wetland to forest

and forest to shrubland, as well as riparian zones and mosaics of forested and open areas. Northern goshawk are extremely sensitive to noise and human activity.

NDOW has conducted annual dawn acoustical, broadcast acoustical, and stand search surveys for northern goshawk in and near the park as part of the EIP since 2001. Nests are protected whether occupied or not, since birds will alternate between several nest sites over a period of years, as stated above. The last nesting goshawk detection within the Nevada State Park lands was in 2004 along Secret Harbor Creek. In 2007, NDOW focused survey efforts on historical nest locations, and within project pre- and post-restoration areas. This effort resulted in one audible detection at an EIP Upland Forest Restoration project site along the boundary of USFS and Nevada Division of State Land (NDSL) property. Another historically active but currently unoccupied goshawk nest is located just west of Sunflower Hill.

Bald Eagle (*Haliaeetus leucocephalus*) are a federally threatened, USFS Management Indicator Species and a TRPA Special Interest Species. Bald eagles winter throughout most of California and Nevada at lakes, reservoirs, rivers, and coastal wetlands. Breeding habitat for the Bald Eagle most commonly includes habitat close to (within 2.5 miles) bodies of water that reflect the general availability of their primary food sources including fish, waterfowl, and other birds. Bald eagle breeding season extends from January through August. Bald eagles construct large stick nests in areas of little human activity in tall trees or on cliffs near water that are used for several years by the same pair of eagles. Nests are normally built in the upper canopy of large trees, usually conifers and may measure up to 6 feet in diameter.

The TRPA, in assistance with the USFS and NDOW surveys annually for nesting and wintering bald eagles. The TRPA 2006 Threshold Evaluation maps indicate a known bald eagle nesting area within the park, specifically along the western and northern shore of Marlette Lake.

California Spotted Owl (*Strix occidentalis occidentalis*) generally nest in cool, shaded areas with a well-developed understory. They prefer natural cavities in large-diameter trees with broken tops and mistletoe infestations and will use mid-successional forests to some degree for foraging. Owls require stands with high canopy closure for thermal regulation and hiding cover and are intolerant of high temperatures and are stressed at temperatures above 80° to 87°F. They tend to roost in small trees in the forest understory during warm weather and higher up in the large trees during cold or wet weather. Layered, multi-storied canopy structure in old forests provides both types of roosts. Sufficient downed logs provide food and cover for many prey species. Surveys were conducted to assess occurrence, presence/absence/non-detection, reproductive activity and success, and spatial distribution of this species.

The California spotted owl is listed as a Sensitive and a Management Indicator Species, by the United States Forest Service (USFS), a Special Interest Species by the Tahoe Regional Planning Agency (TRPA), and as a Species of Conservation Priority in the Nevada Wildlife Action Plan (WAP). Unlike the northern and Mexican subspecies, the California spotted owl has not been listed as a threatened species under the U.S. Endangered Species Act.

NDOW has conducted annual spotted owl surveys within the park as part of the EIP since 2001. In 2002 and 2006, there was one detection on the lower North Canyon creek route, but nest searches found nothing and no other detections were made. Detections within the North Canyon

Creek route in 2002 and 2006 may be the same California spotted owl since they can live up to 17 years. Two spot-calling surveys were conducted within Nevada State Parks along the east shore of Lake Tahoe, North canyon, and Van Sickle Bi-state Park in 2007. In total, one vocal detection was noted along the upper North Canyon creek route and none were recorded on the Van Sickle route. A second visit was made to North Canyon to conduct a nest search, but nothing was found. The lack of suitable late successional old growth habitat in contiguous stands is possibly the reason for so little activity on the eastern side of the Lake Tahoe basin.

Blue Grouse (*Dendragapus obscurus*) are primarily a solitary montane species found in coniferous forest, especially fir, mostly in open situations with a mixture of deciduous trees and shrubs. They spend winters usually at higher elevations than summer habitat in conifer forest of various categories of age and tree density. Blue Grouse roost in large conifers with dense foliage. Nests are found in montane (mixed or deciduous) forest on the ground under cover of brush, branches, or other vegetation. The breeding season begins in late May in north and this species may renest if its nest is destroyed. In summer, grouse feed on a variety of berries, insects, flowers, and leaves. In the winter it feeds mainly on the needles and buds of conifers. Blue grouse have been observed in North Canyon.

Osprey (*Pandion haliaeetus*) are a TRPA Special Interest Species. Osprey usually nest in dead tree (snags) near sources of open water. The only known osprey nesting activity in Nevada occurs at Lake Tahoe (Nevada Department of Wildlife, 1985). Habitat and nesting sites for osprey occur within the park and are frequently observed in the vicinity of Tunnel Creek, Sand Harbor, and Spooner Lake. Four historical osprey nests within 0.25 miles (threshold disturbance zone set by the TRPA) of SR 28 between Incline Village and Sand Harbor. Of these four nests, three have been physically damaged and/or destroyed and no longer have the potential to be used for nesting. Recent surveys for active nests located one additional nest, approximately 0.50 miles south of Sand Harbor and 0.90 miles from SR 28.

Through the EIP, osprey surveys have been completed since 2001 to determine area occupancy, individual and pair status, nesting status, and reproductive success. Survey areas were established in suitable habitat where osprey had been detected historically, or within ¼ mile of lake shore zones and project implementation sites. Four survey sites on the eastern shoreline of Lake Tahoe were visited by NDOW in 2007, including Memorial Point along the upper ridge, South Slaughterhouse Canyon and the eastern ridge of Marlette Lake Basin. These surveys confirmed one fledgling per nest at Memorial Point. Historically there have also been several nests located in dead trees along the lake shore below SR 28, but these have since fallen over.



Figure 7. Nesting osprey above Memorial Point approximately ½ mile east of Lake Tahoe in the Bonpland Creek drainage (2006). Photo courtesy of Nevada Department of Wildlife.

The **Southwestern willow flycatcher** (*Empidonax traillii*) is a Neotropical migratory species that during the last five decades has been extirpated from most of its range in California. It is found in montane meadows in the Sierra Nevada in thick stands of willow, typically greater than 10 acres in size. There is concern that the Sierra Nevada population may be continuing to decline. Within the park, willow flycatcher habitat is found along the Franktown Creek drainage and Hobart Reservoir, in the upper portions of North Canyon, the northern end of Marlette Lake and around Spooner Lake, and in portions of Spooner Meadow and Slaughterhouse Canyon. To date, no willow flycatchers have been observed in the park.

The Lahontan cutthroat trout (Oncorhynchus clarki henshawi) historically occured in a wide

variety of cold-water habitats including Lake Tahoe and its tributary streams. Generally, Lahontan cutthroat trout habitat includes cold streams with significant cover of well-vegetated and stable streambank and rocky riffle-run areas. The park does not provide suitable habitat for the Lahontan cutthroat trout because it lacks these habitat features.



Fisher (Martes pennanti) are largely

carnivorous members of the weasel family, feeding on rabbits and hares, especially snowshoe hares, and rodents (mice, porcupines, squirrels, mountain beavers), shrews, birds, fruits, and carrion. Fishers use cavities in large trees, snags, logs, rock areas, or shelters provided by slash or brush piles as cover. They prefer dense, mature stands of trees that provide cover, especially

in winter and will den in a variety of protected cavities, brush piles, logs, or under an upturned tree. Hollow logs, trees, and snags are especially important. Suitable habitat for fishers consists of large areas of mature, dense forest stands with snags and greater than 50% canopy closure.

Like the fisher, the American marten (*Martes americana*) is a mustelid similar in size to a house cat. American martens prey on small mammals, particularly mice and voles and prefer dense, old-growth conifer and mixed stand habitat. Stands must have sufficient understory to support various rodents, such as mice (Cricetids) and voles (Microtines), the major food source. Martens usually den in rotten logs and may also den in rock slides and slash piles. American martens require dense conifer or mixed forests with 40 to 60 percent canopy closure for cover. Dense understory, including slash or rotten logs and stumps, is necessary for denning and hiding though they will avoid areas that are so dense that herbaceous cover is suppressed. Open areas adjacent to these forests will be used for hunting only if they provide adequate hiding cover and food. Uneven-aged stands are most beneficial because their vegetation is more diverse which leads to a greater food base.

Sightings of the American pine marten have been confirmed throughout the Nevada portion of the Lake Tahoe Basin. Historical locations are difficult to determine due to forest structure being impacted by logging and fire suppression. However, potential American marten habitat was mapped by Espinosa and Romsos in 2001 using a combination of elevation, climate, steep and varied topography and edaphic soil conditions. The absence of pine marten detections within Lake Tahoe Nevada State Park is a mystery. During the four seasons surveying for American Marten, only four images have been captured, one within the Marlette Lake basin east of Lake Tahoe, three within the Van Sickle Bi-state park along the South shore of the Lake (Stateline) and the historical site along the ridges of the Mount Rose Ski resort outside the Tahoe basin along Hwy 431.

The **Sierra Nevada red fox** (*Vulpes vulpes*) is the only indigenous subspecies in Nevada. It preys primarily upon small mammals including: mice, bushy-tailed woodrat, Douglas' squirrel, Belding's ground squirrel, alpine chipmunk, and white-tailed jackrabbit. Lagomorphs are common in the diet of red fox. They tend to use the highest timbered peaks in the Sierra Nevada and feed above timberline into fall and winter. Habitat use generally includes barren, high-elevation conifer (red fir, sub-alpine conifer), mid-elevation conifer (Lodgepole pine, Sierra mixed conifer, and white fir), shrub (montane chaparral), and hardwood-herbaceous (Annual grassland, aspen, montane hardwood, montane riparian and wet meadow). Fire suppression, meadow encroachment, and grazing may shift availability of prey species to higher abundance of different prey species, negatively affecting red fox populations.

Wolverine (*Gulo gulo*) are the largest and most rare member of the mustelids. Its appearance is somewhat bear-like, although movement and associated behavior are distinctly characteristic of the weasel. The wolverine is powerfully built, with structural morphology apparently adapted for winter survival. Habitat use montane coniferous forest types over wide home ranges. Vegetative characteristics are less important to wolverine than physiographic structure of the habitat. Protection of natal denning habitat from human disturbance may be critical for the persistence of wolverine.

Mountain beaver (*Aplodontia rufa*) are primitive rodents that are not actually related to beavers (*Castor canandensis*). Their habitat includes deciduous and coniferous forests, though they prefer to burrow along streams. These animals appear to be physiologically limited to moist microenvironments, with most subspecies occurring only in regions with minimal snowfall and cool winters. Mountain beavers build elaborate burrow systems with chambers devoted to fecal and food caches. Their diet includes fleshy herbaceous vegetation and young shoots of woody plants.

Previous recorded sightings of mountain beaver in Nevada date prior to 1946. The capture of two individuals in 2001 on the California side of Lake Tahoe prompted a search of suitable habitat on the Nevada side and the initiation of an annual monitoring effort by the Nevada Department of Wildlife. During 2001, mountain beaver were recorded in Tunnel Creek and the headwaters of Bonpland Creek. Annual surveys conducted in subsequent years have identified several other colonies throughout the park, including near Marlette Lake, the drainage along Lakeview road, and along tributaries west of Red House and above Hobart Reservoir (see Wildlife Resources Map in Appendix J).

Mountain yellow-legged frog (*Rana muscosa*) are a very rare amphibian found along sunny riverbanks, meadow streams, isolated pools and lake borders in the Sierra Nevada. These Sierran frogs are most abundant in high elevation lakes and slow-moving portions of streams. They are seldom found away from water, but may cross upland areas in moving between summer and winter habitats. Wintering sites include areas nearshore under ledges and in deep underwater crevices. Breeding occurs March-June at lower elevations and May-August at higher elevations. At high elevations, larvae require 2-3 summers to reach metamorphosis and they become sexually mature 3-4 years following metamorphosis. Adults eat aquatic and terrestrial invertebrates and anuran larvae.

Numerous population declines and local extirpations have occurred and are ongoing. It is thought that introduced trout are a major factor in the decline, along with disease, recreational activities, and airborne agrochemicals. This species is a candidate for Federal listing under the Endangered Species Act.

Cultural

Cultural resources encompass the physical remains of past cultures, including prehistoric archaeological sites and historic buildings and structures. A primary mission of the Division of State Parks is to identify, protect, and interpret these cultural resources under its jurisdiction.

The park area lies within ethnographic territory of the Washoe tribe and archeological sites may be encountered throughout the park. A portion of the park is also located adjacent to Cave Rock, a natural feature on the east shore of Lake Tahoe that holds religious significance for the Washoe. Many notable historic resources related to the Comstock logging era are found within the park, including Red House and Hannah's Cabin, logging flumes, railroad grades, and the Marlette Lake Water System infrastructure.

Archeology

Native Americans, primarily members of the Washoe tribe, occupied the region beginning approximately 8,000 to 9,000 years ago. Prior to the arrival of Europeans in the 1850's, the Washoe occupied a territory encompassing approximately 4,000 square miles that included Lake Tahoe, Honey Lake, south through Antelope Valley and the West Fork of the Walker River. Seasonally availability of resources dictated tribal movements and encampments, including fish, rabbit, and pine nut harvesting.

Lake Tahoe was visited during spring to fall and was favored for small and big game hunting, as well as plant and insect gathering. Lake Tahoe is remembered as the summer destination of many Washoe families and their associates, and a critical component of their traditional economy, society, and culture. Young male members of the tribe would return to summer camps at Lake Tahoe to reclaim favored fishing spots and rebuild the camps for family and guests who came and went throughout the summer and fall. Tribe members would remain at the camps until it was time to return to the Carson Valley for pine nut and acorn harvests.

Within the park, the Bonpland Creek watershed was frequented by Washoe families who worked and camped at the lake until incoming Euroamericans encountered Washoe people in the 1840s. This drainage is of special significance to the Washoe family descended from John Nevers due to the quality and value of the water from this creek. John Nevers built boats that he kept hidden in the riparian vegetation along this secluded creek. He gave up this practice sometime in the late 1950s-early 1960s, after the last of three of his rowboats had been stolen (Lindström 2004).

Additional evidence of Native American presence in the park can be observed at grinding stones located at both Sand Harbor and Spooner Lake. The Washoe refer to Spooner Summit as "dawmaladup solno" or "fog on top." Pre-Archaic to Early Archaic occupation from about 7,000 years ago has been documented at Spooner Lake (the "Spooner Phase") near Spooner Summit. The group of grinding stones, described below, is evidence of the sustained presence a small Washoe village at Spooner Lake. Similarly, a Native American site consisting of a bedrock milling feature at Sand Point, lithic scatter, and possible hearths exists on the beach and dunes indicate that Sand Harbor was also frequented by Washoe families who worked and camped at the lake. This site is also noted on the 1984 TRPA Historical Map. Susan Lindström, regional archeologist, has also anecdotally observed a possible submerged bedrock milling feature in

Diver's Cove at a depth of about 15 feet. Recollections from residents of cabins at Sand Harbor document that the Washoe maintained occupation at the lake into the 1940s.

Although Cave Rock itself lies outside the park boundaries, Washoe have described *De'ek wadapush* ("standing gray rock") as a place of power and have used the area traditionally for spiritual activities. The Washoe believe that if traditions surrounding Cave Rock are restored and adhered to, a positive influence on all life will be affected. The park boat launch area lies within a zone of caution where a respectful attitude should be maintained and where special observances may take place, according to Washoe beliefs. The Washoe concede that the tunnels and the boat ramp are irreversible.

History

John Charles Fremont and Kit Carson discovered Lake Tahoe in 1844. Originally known as Mountain Lake, Bonpland Lake, and Lake Bigler, a California cartographer known as William Henry Knight began an 82 year crusade to change the name to Tahoe. Henry De Groot, another mapmaker and writer, recalled a Washoe tribe elder mentioning the word "Tah-hoe", probably meaning "water in a high place". Finally, in 1945, the Californian legislature officially changed the name to Lake Tahoe.

The Comstock boom in 1859 created a demand for fuel wood and timbers for the Comstock mines. To address this need, lands in and around the park were logged by the Carson Tahoe Lumber and Fluming Company in the south and the Sierra Nevada Wood and Lumber Company in the north. Logs were then transported via flumes to the Carson and Washoe valleys and eventually to Virginia City. Remnants of this era can be found scattered throughout the park in the form of discarded tools and debris at camp sites, high cut tree stumps, cabins such as Spencer's Cabin and the log base of a woodcutter's cabin in North Canyon along the Marlette Lake Trail, and logging roads such as the Tunnel Creek Road/Trail Complex. This system is a network of 19th century mule trails in the Tunnel Creek drainage that was used to transport cordwood from the main trail (road) that accessed Lake Tahoe and areas east of the Tahoe divide and is now considered an important historic resource.

The Carson Tahoe Lumber and Fluming Company (CTLFC) was formed in 1871 by Duane L. Bliss and H.M. Yerington to provide lumber for Virginia City. CTLFC owned approximately 7,000 acres of forestland in the vicinity of Spooner and Glenbrook, along with an extensive network of wood and flume camps, flumes, haul roads, and railroad. In particular, the company acquired the Summit V-flume from Summit Fluming Company, which ran from Marlette Lake through North Canyon to Spooner Summit for the purpose of providing water to the Clear Creek Flume. CTLFC also constructed a narrow gauge railroad ("Glenbrook Railroad" or "Lake Tahoe Railroad") that carried lumber 910 vertical feet from the mill at Glenbrook to Spooner Summit via North Canyon Creek. At Spooner Summit, lumber was staged and flumed down to the lumber yard in Carson City via the Clear Creek Flume.

The Sierra Nevada Wood and Lumber Company (SNWLC) operated in the northern portion of the park. The SNWLC was formed by Walter Scott Hobart and Seneca Hunt Marlette, who constructed a mill on Mill Creek in Incline Village in 1878. To supply the mill with timber, the General Manager (John Overton) constructed a narrow gauge tramway that rose 1,400 straight up

the side of a mountain. The double-tracked incline railway (dubbed the "Great Incline Tramway") was powered by a 40-horsepower steam engine and used two 12-foot bull wheels to hoist logs. Lumber would be hauled up from the mill to the Virginia and Gold Hill Water Company's (see below) north flume, where they would float 1½ miles to Tunnel Creek Station and through a 4,000-foot tunnel under the Carson Range to eventually reach the flume dump at Lakeview above Washoe Valley. Access to the flume and its water was facilitated by the fact that Hobart served on the Board of Director's for the VGHWC and Overton was the Superintendent of the system. SNWLC also acquired a steamship (Niagara) in 1880, which hauled logs from the south end of the lake to Sand Harbor (figure 8). These were then transported via rail to the Incline mill.



Figure 8. Log train at Sand Harbor, 1894 (photo courtesy of Nevada Historical Society).

The development of the Marlette Water System (MWS) transpired concurrently with large-scale timber harvesting for the Comstock. The MWS was developed as a means to provide water for mining and residents in Virginia City, Gold Hill, and Silver City.

In 1871, the Virginia and Gold Hill Water Company began developing a water system stretching over 21 miles to the west using an inverted siphon, pressure pipeline designed by Hermann Schussler, a German-born engineer from San Francisco. In 1873, the first water from Hobart Creek in the Carson Range reached Virginia City and Gold Hill. The water system was constructed in three phases over time. The first phase involved the construction of a small

diversion dam on upper Hobart Creek at Red House. Water was then transported via a 4.62-mile wooden flume to a tank that served as the inlet for the inverted siphon pipe at an elevation 351 feet higher than the outlet end of the pipeline in the Virginia Range. From the tank, water was conveyed in riveted, wrought iron, 11½-inch pressure pipeline extending seven miles, down to the lowest point on the system at Lakeview and back up to the high point in the Virginia Range where it then flowed in a 4.04-mile flume to a point where Five-Mile Reservoir was constructed. From the reservoir, water was carried in a 5.66-mile flume to tanks located above Virginia City and Gold Hill.

Increased mining activity and a fire in Virginia City in 1875 required additional water, resulting in the second phase of water system construction. John Overton oversaw the construction of another wooden flume 4.72 miles in length paralleling the first flume coming from Hobart Creek. This led into a second tank next to the first, where it entered a second pipe that was somewhat (1,900 feet) longer than the first to the Virginia Range outlet. There, water entered another flume that paralleled the first to Five Mile Reservoir. From the reservoir, a second flume took water to another reservoir situated between Virginia City and Gold Hill.

With the need for even more water, a third addition to the water system was made in 1876. A flume was constructed, this time leading from Marlette Lake in the Lake Tahoe basin to what is now known as Tunnel Creek Station. At that location, a tunnel was excavated 900 feet below the crest of the Carson Range and allowed water from the Marlette Lake Flume to flow through the tunnel to another flume that carried the water to the current Hobart Reservoir. A new flume carried water to the inlet tanks and a third pipeline carried it over to the Virginia Range. Additional water was also acquired through the construction of the North Flume (carrying water from First, Second, Third, Tunnel, and Mill Creeks) to the tunnel entrance. With these additions, the Marlette Water System included three reservoirs, more than 21 miles of pressure pipes, 46 miles of covered box flumes, and a tunnel. To maintain and operate the water system, houses and stations were constructed at Marlette Lake, West Tunnel Portal, Hobart Reservoir ("Red House"), The Tanks, Lakeview, and Five Mile Reservoir. At Red House, a workers' bunkhouse and icehouse were constructed.

In 1933, the water company's name was changed to the "Virginia City Water Company." Continued failures in the aging pipeline and a lack of funds caused the company to sell the water system to Curtiss-Wright Corporation in 1957. After making certain improvements to the system, Curtiss-Wright subsequently sold it to the Marlette Lake Company. In 1963, the Marlette Lake Company sold the water system to the State of Nevada for \$1.65 million. More comprehensive discussions of the history of the Marlette Lake Water System are contained in Bulletin No. 79 of the Legislative Counsel Bureau—*The Marlette Lake Water System—A Report on the Feasibility and Desirability of its Retention*, February 1969, and Bulletin No. 01-20—*Continued Review of the Marlette Lake Water System*.

There are numerous remnants from various periods of the MWS located within the park, including the tunnel at Tunnel Creek and Tunnel Creek Station debris pile, the remains of the foundation of the Marlette Lake Dam Master's house near the Marlette Dam, portions of the flume system, the steam boiler along Lakeview Road, Red House and Hannah's Cabin.

Spencer's Cabin

Spencer's cabin was constructed in the late 1920's for use as a residence for the cattlehand. Spencer worked for Charlie Folston, who first held the lease to run cattle in Spooner meadow and what is now Spooner Lake. He later worked for Harry Anderson, who acquired the lease from Folston. Spencer was responsible for irrigating the meadow, managing the herd and removing beaver dams. The cabin was never used by Basque sheepherders, but remained a cattleman's cabin until the late 1960's.

Red House

Red House and its associated buildings, collectively referred to as the Red House complex, were constructed in 1910 and consist of three structures: the residence, a storage building, and a bunk house. The three buildings are constructed with posts and beams, and covered with board and batten walls. The main house ("Red House") served as a residence for the Marlette Water System attendant and his family below the Hobart Reservoir dam. The bunkhouse housed summer maintenance crews. Red House was used as a year-round residence until the late 1930' or early 1940's, and thereafter as an emergency shelter by Red McGovern until 1960. Red House was partially stabilized in 1978 using Youth Conservation Corps members, and again in the 1990's with NDF Conservation Camp honor crews.

The current buildings were constructed to replace the original Red House that was constructed circa 1887, but was destroyed in a flood in 1907. In addition to the structures, a 1924 Dodge Roadster automobile is also located on site, but is not associated with the original use of Red House.

Tunnel Creek Station

Tunnel Creek Station is an historic site associated with the Marlette Lake Water System. It was constructed in the late 1870's or early 1880's as a key maintenance station on the MWS. One of eight such maintenance stations, it was situated on the west side of the Carson Range at the meeting point of the North Flume, the Marlette Lake Flume, the Sierra Nevada Wood and Lumber Company V-flume, and the west portal of the tunnel through the Lake Tahoe basin divide. Originally, Tunnel Creek Station included a stationmaster's house, outbuildings, and a telegraph/telephone line. Today the site consists of saw cut boards from associated flumes, cut nails, welded pipes, domestic items (glass fragments, wire, etc), and foundation walls.

Hannah's Cabin

Hannah's Cabin, also known as the "Ranger's Retreat", is named after Hannah Hobart-Prince, the granddaughter of Walter Scott Hobart. Walter Scott Hobart was the founder of the Sierra Nevada Wood and Lumber Company at Lake Tahoe and on the board of directors for the Virginia Gold Hill Water Company. Handyman Amido Gavasi constructed the cabin from fir and aspen in 1929 along Franktown creek as a retreat for Hannah. A telephone was wired to the cabin and visitors were obligated to call prior to arriving. Hannah Hobart was born on March 14, 1897 and died March 8, 1978.

Sawmill Boiler

At the eastern edge of the park boundary along Lakeview Road the head of Sawmill Canyon are the remnants of a steam driven sawmill complex. The overall site dates between ca. 1880 and 1905, and includes a likely Euroamerican habitation area, a Chinese living area; and a large iron boiler with associated industrial debris, and the remains of the mill itself. The boiler is a cylindrical tube made of spiral-riveted steel plates that represents a steam sawmill and dates between ca. 1880 and 1910 (figure 14). The site is recommended as eligible for the National Register of Historic Places (NRHP) based on the excellent state of preservation, the rarity of such features in the Carson Range, and as an excellent example of a type of steam boiler associated with 19th century Comstock lumbering and steam technology (figure 15).

Rocky Point Chimney

A solitary granite fireplace is all that remains of a one-room building constructed in 1933 on a small rocky point along the southeastern shore of Marlette Lake. The original cabin was built by Mr. and Mrs. James M. Leonard, Superintendent of the Virginia and Gold Hill Water Company. The cabin was used by the family of Hobart Leonard, son of James M. Leonard, as a summer retreat.

Marlette Lake Dam Master's House

The remains of the Marlette Lake Dam Master's station include a house foundation located off the road near the dam. Originally, the station complex was comprised of a caretaker's main residence, a stable/barn, blacksmith shop, summer and winter outhouses, and a large refuse dump. Structure foundations were destablized when the lake was raised by Curtis-Wright Corporation ca. 1959 and the station complex was demolished ca. 1960.

Woodcutter's Cabin – North Canyon

Remnants of a cordwood cutter's cabin consisting of a rock structure, notched walls, high-cut stumps, and a few small artifacts are found along the Marlette Lake Trail on the west side of North Canyon. Lumber and water companies built numbers of these simple cabins as work camps to provide living quarters for immigrants in the 1870s and 1880s. This cabin's close proximity to the primary flume and wood haul road indicates that it may have been a woodcutter's camp.

The size of this cabin suggests that four to five men lived in it. A rock structure, which may have been a cooking stove, and other artifacts suggests that Chinese-American workers lived here in the 1880s. Additional more recent artifacts, such as hole-in-top food cans, indicate that EuroAmericans moved in, displacing the Chinese-Americans.

Spooner Lake Milling Site

A site previously occupied by members of the Washoe tribe is located along the northwest portion of Spooner Lake. The site is a small prehistoric village consisting of a dense cluster of milling stations and occasional surface scatter of flake and tool remnants (figure 17). The

presence of this site requires the management of the water level at Spooner Lake so that inundation does not accelerate damage to the resource.

Arborglyphs

Basque sheepherders, many of whom arrived following the discovery of the Comstock Lode, grazed flocks in meadows surrounding Marlette Lake. The ample amount of leisure time and the availability of aspen trees were the catalysts for Basque sheepherders to create a unique western cultural phenomenon of tree carvings. The carvings typically date from June through September and are located in aspen groves in drainages and wet meadows in remote canyons, generally above 6,000 feet in elevation. Called arborglyphs, these carvings were written in several languages. Much of the text is slang with swear words that are not translatable. The content of the arborglyphs included names and dates; anthropomorphic and zoomorphic forms, which center on females, sex and courtship; ethnicity and Old World themes; interpersonal matters between sheepherders; and fantasy forms. Arborglyphs are found on aspens throughout the park, and in particular at the bottom of North Canyon Creek before it enters the meadow, Slaughterhouse Canyon, and in the vicinity of Hobart Reservoir.



Figure 9. Spencer's Cabin at the bottom of North Canyon.



Figure 10. Red House, used as a caretaker's cabin for Hobart Reservoir.



Figure 11. Hannah's Cabin.

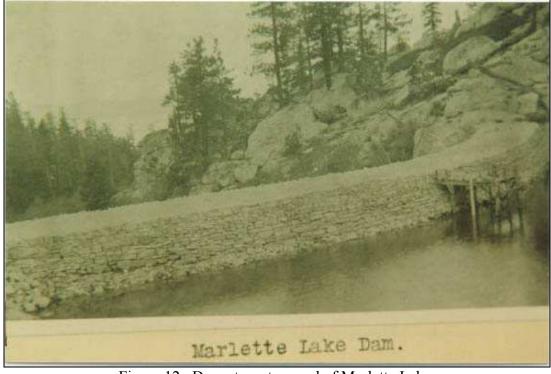


Figure 12. Dam at western end of Marlette Lake.





Figure 14. Sawmill steam boiler at Lakeview Road.

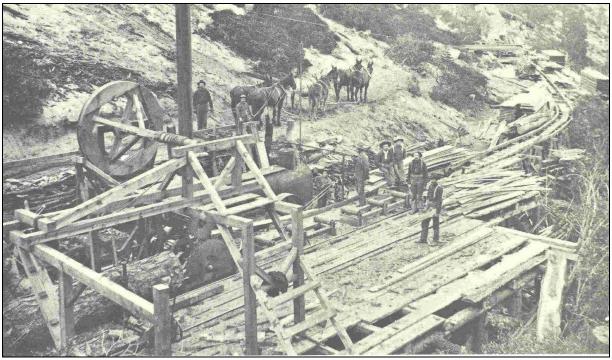


Figure 15. Sawmill as it may have looked during operations.

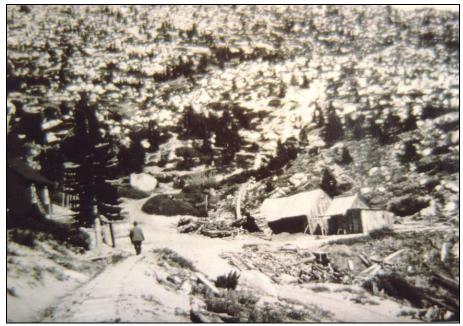


Figure 16. Tunnel Creek Station.



Figure 17. Mortar holes at Spooner Lake mill site.

Van Sickle Cultural Resources

In 1988, Jack Van Sickle donated 542 acres of property to the Nevada Division of State Parks to form the "Henry Van Sickle Unit of Lake Tahoe Nevada State Park" in honor of Jack's grandfather. His donation contained the stipulation that the park include no commercial equestrian or ski resort facilities within its boundaries. Later, Parks secured an additional 28 acres of adjacent property, for a total of 570 acres.

In addition to the property he donated to NSP, Mr. Van Sickle also owned 155 acres in California adjacent to the Nevada site that included a possible park entrance off Montreal/Lake Parkway. In 2001, NSP initiated discussions with California State Parks (CSP) regarding the formation of a joint California/Nevada State Park. CSP then approached the California Tahoe Conservancy (CTC) to see if they would be interested in purchasing the property and then turning it over to CSP for management in the future. In 2002, the CTC purchased the land, including an access right-of-way for public entrance into the Nevada property via the California side. Additionally, Mr. Van Sickle donated two acres opposite Park Avenue to serve as a park entrance. Together, these acquisitions created an opportunity to create a bi-state park in South Lake Tahoe.

Cultural resources at Van Sickle are primarily located on the California side of the park. They include a 2,040 square foot barn that dates from the 1860s, a small log cabin dating from the 1910s-1920s, and ten 1930s-1940s housekeeping cabins, all of which were variously incorporated into a historical equestrian stable complex that operated for approximately 80 years.



Figure 18. Barn structure, construction circa 1860.

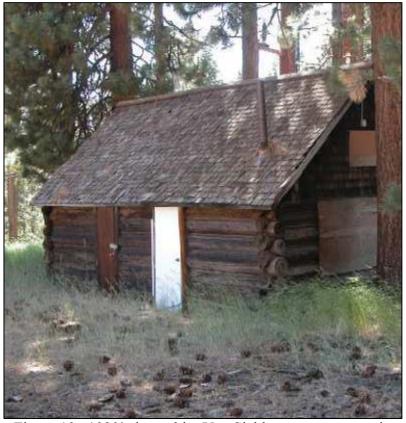


Figure 19. 1920's log cabin, Van Sickle management unit.

Primary Resource Issues

<u>Forest habitats</u> of the Carson Range have been significantly impacted by human activity since European discovery in 1844, including logging activities related to Comstock mining operations and the elimination of fire over the past hundred years in response to a nation-wide policy of aggressive fire suppression. As a result, today's forests are less structurally diverse, support fewer wildlife species, and are more prone to experience <u>catastrophic wildfire</u> and outbreaks of insects and disease. Fire suppression techniques, repeated <u>drought cycles</u>, <u>insect infestation</u>, and diseases have combined in the east slope of the Park to result in a thick forest with significant ladder fuels (lower branches on trees) and both dead and down and standing dead plant material. Due to the condition of this forest, it has the potential to carry intensely hot and devastating wildfires. The entire Park and the surrounding areas are susceptible to these wildfires.

Previous disturbances and on-going use of the park have resulted in other resource issues as well. Many <u>roads</u> and <u>trails</u> have eroded, depositing soil into waterways and increasing stream power by concentrating flows that would normally infiltrate into the ground and therefore require the implementation of Best Management Practices (BMP's) or re-routes. <u>Stream habitat</u> and function are impacted in areas where banks are actively eroding, culverts are undersized, and channels are straightened and downcutting. Protection of both stream forest habitats is critical to ensuring the long term survival of species found within the park.

Carrying capacity is defined as the type and level of visitor use that can be accommodated while sustaining the desired resource and social conditions that compliment the purpose of the recreation area and its management objectives. The concept was first addressed as a park management concept in the 1930's for National Parks and has received increasing attention since the 1960's. However, the application of the concept in parks has proven to be a much more complex concept, as a critical dimension of carrying capacity deals with the social aspects of the visitor experience. Defining carrying capacity depends upon defining the type of visitor experience to be provided and be able to monitor that experience over time. Too often carrying capacity is mistakenly thought of as a fixed number that can be defined through research when it is actually less a prescription of number of people and more of a prescription of desired ecological, social, and management conditions that give value to a recreation area.

Current use of recreation facilities within the Sand Harbor and Highway 28 Management Units during peak months are thought to exceed sustainable capacity levels of the resources and developed recreation facilities. Additionally, recreation use in Lake Tahoe is projected to increase by 50,000 visitors each year over the next twenty years, resulting in an overall increase of one million visitors basin-wide. Developing a strategy to effectively manage public use at heavily used park facilities is critical in order to maintain the balance between resources and user demand.

A carrying capacity study is currently being developed for the Sand Harbor and Highway 28 Management Units. It is anticipated that the study will utilize the concept of recreation carrying capacity to manage a sustainable recreation experience. Outside of the primary high-use areas, defining a carrying capacity is less of an urgent need, but there still remains a need to balance recreational experience with the protection of resources.

Threats to <u>cultural resources</u> include theft, vandalism, unintentional damage from visitors, disturbance or damage from management activities, and "demolition by neglect." Of these, neglect is often regarded as the greatest threat to structural heritage resources, such as Red House.

Invasive species represent an increasingly large threat to natural resources throughout the west every year because of their ability to rapidly spread and out-compete native species. Terrestrial invasive weeds are typically not native to North America, originating in Europe or Asia. When these invasive weeds arrive in Nevada, they spread unchecked, as there are no naturally occurring enemies to control them. Implementation of development and resource management projects, as well as the large numbers of various vehicles travelling in the backcountry, represent a significant potential source of non-native species introduction. Blister rust, an exotic fungus that attacks members of the white pine subgenus, continues to reduce the number of sugar pines in montane forests, and over time may effectively eliminate the species from the ecosystem. Sugar pine is one of the most important food sources for seed-eating animals in the mixed-conifer zone, and the potential consequences of its decline are largely unknown.

Aquatic invasive species (AIS) include both aquatic plant and aquatic animal species with potential impacts that can be extreme and affect ecosystems, recreation, and economics. AIS infestations are generally permanent, and where control and/or eradication is possible it is very costly; prevention is typically the only good strategy to combat them. Within Lake Tahoe, AIS include Eurasian watermilfoil, curlyleaf pondweed, large mouth bass and other warm water fish species. The existence of these species in the Lake has started to disrupt the food web, has impacted water clarity and has had a deleterious effect on native fish populations such as the Lahontan redside shiner and speckled dace.

Three other AIS recently have become identified as a major threat to Lake Tahoe and directly impact boat ramp operations at the park. These include Zebra mussels, Quagga mussels, and the New Zealand mud snail. Currently, Lake Tahoe and other lakes of the Tahoe Region are believed to be free of quagga and zebra mussels; however, experts fear that these invertebrates could spread quickly and cause the following impacts:

- Disrupt aquatic biologic communities, fishing and recreation.
- Foul facilities such as docks and ramps.
- Encrust boats and clog engines.
- Litter beaches with sharp odiferous shells.
- Cause impacts to water quality that would increase costs for drinking water treatment.
- Clog drinking water and other intake pipes, increasing maintenance costs to these systems.

Occasionally, <u>utilities</u> such as cellular relay towers and transmission or gas lines may be proposed within the park to provide service to the Lake Tahoe basin. These activities have the potential to significantly impact sensitive habitats and the scenic quality of backcountry, via initial construction activities and on-going maintenance.

Resource Management Guidelines

This section provides general resource management guidelines that are intended to protect and enhance resources within the park. Additional special consideration guidelines are outlined for specific zones, uses or features, where appropriate. Note that there are additional regulatory restrictions required by other agencies beyond the guidelines outlined in this document, including the Tahoe Regional Planning Agency, Nevada Department of Wildlife, Nevada Division of Forestry, and the State Historic Preservation Office.

Special Use Permits

Commercial and special use permit proposals should be consistent with the setting and ambience of the management zone in which it is proposed. For additional information, refer to State Parks Policy # 00-19.

Hunting and Fishing

Hunting and fishing activities are permitted in designated areas of the park (see Appendix J). Firearms or bow and arrow may be carried and discharged in accordance with the regulations of the Department of Wildlife during regulated seasons in these designated areas. Generally, the designated areas are located in the northern half of the Marlette-Hobart Backcountry management unit, with the following exceptions where hunting is prohibited for public safety:

- Within 1,000 feet east of SR 28 and all areas west of SR 28;
- Within 1,000 feet of Red House and its associated structures
- Within ½ mile of Hobart Reservoir
- Within 1,000 feet of Tunnel Creek Road from SR 28 to Twin Lakes
- Within 1,000 feet of the Marlette flume Trail, backcountry roads, and designated trails.

Weapons discharge is prohibited outside of the designated hunting areas, per NAC 407.105. Hunters are also required to retrieve all shell casings and associated litter.

Roads and trails

Erosion control and road/trail sustainability are critical issues within the entirety of the park. Critical to the proper management of the road and trail system within the park is the development of a Trail Management Plan, as described in the Projects section of this document. The plan should identify which roads and trails need to remain open, assess needs of each in terms of Best Management Practices and sustainability, which roads could be closed or converted to trails, and what new trails are needed. Some trails within the park were constructed many years ago using different standards for trail construction and design and may need to be modified or relocated.

To provide for the highest quality user experience while protecting significant habitats, the following guidelines should be considered when developing trails:

- Create loop systems;
- Incorporate accessibility or universal design opportunities;
- Avoid crossing through sensitive critical habitats, and;
- Utilize natural features and be compatible with the backcountry setting.

Roads provide a different challenge from trails. Many of the existing roads are used for administrative access, including not only parks staff, but Buildings and Grounds, private landowners, and utility companies. Some of these same roads serve dual purposes as trails as well, providing hikers and mountain bikers access throughout the park. North Canyon and Hobart Road are notable examples. In order to protect sensitive habitat, reduce water quality impacts, and provide needed administrative access, the following guidelines should be followed:

- Temporary roads, or access ways created as part of public or commercial management activities, should be decommissioned to prevent vehicle travel as soon as practical and/or upon completion of the use;
- Temporary and seasonal road closures should be considered when the road surface can be damaged or may adversely affect water quality and other resource conditions;
- Road building and road maintenance should be avoided or minimized in areas of high
 mass soil instability, and should be designed to protect water quality and scenic value in
 areas of moderate stability;
- New stream crossings and replacement stream crossings should be designed to pass at least the 100-year flood, including bedload and debris;
- Stream crossings should be designed to maintain streamflow in the channel in the event of failure of a road crossing;
- Stream crossings should be designed to maintain natural hydrologic flow paths where feasible, including avoiding diversion of streamflow and interception of surface and subsurface water;
- Road projects should avoid SEZs and meadows or minimize effects to natural flow patterns in SEZs, and;
- Roads and facilities should be located to avoid earthquake fault zones whenever possible.
 Where potential slope instability is identified for road projects, site-specific mitigation measures should be developed.

Forest Management

The overall goals for forest management within the park are to reduce fuels and the threat of wildfire, improve habitat and forest health, and move the forest towards increased old growth and heterogeneity. To meet these goals, two forest management programs have been developed for the park, both of which are included in federal *10-Year Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategies* for the Lake Tahoe Basin and Carson Range, respectively.

Within the Tahoe basin, the Forest Restoration program is overseen by the Nevada Division of Forestry and implemented in several continuing phases through the EIP. Phases I and II focused on addressing forest management concerns in the Spooner, North Canyon, and Tunnel Creek portions of the park. Phase III continues this work in Slaughterhouse Canyon, Tunnel Creek, along SR 28, and the Van Sickle management unit.

Outside of the basin, park forestry management follows the *East Slope Forest and Fuels Management Plan* (see Appendices J and K). The plan identifies priority areas for treatment on the east side of the park, with the highest priority areas being fuel breaks located within 150 feet of the primary travel roads in the backcountry and Spooner Summit (Priorities 1 and 2). These areas received initial treatment in 2008 and 2009. Priority 3 areas, located outside and adjacent to the fuel breaks near Hobart, Little Valley, and Spooner Summit, began to be treated in 2009. Upon completion of Priority 3 and 4 areas, the plan should be updated to include additional treatment areas, identify potential prescribed fire areas, and maintenance needed for the initial priority areas.

General Guidelines

The following guidelines will be implemented in general forest areas, though they may be modified depending upon site conditions, opportunity, resource values (such as sensitive species), input from other resource specialists, and the potential for ignition.

Treatment areas should be thinned to an approximate target basal area range of 80 to 150 square feet per acre, depending upon site conditions and threat. Stand basal area is used in order to adequately describe the density of trees in an area relative to growth potential and natural distribution, which cannot be accounted for with strict tree spacing guidelines. Similarly, using basal area as a management tool allows projects to result in a more naturally appearing distribution of trees (clustered) over a large area. However, as a visual guideline for managers, the above basal area for much of the second-growth forest in the park may be approximated with a tree spacing of 5-10 feet between crowns and 20-25 leave trees per acre.

Trees identified as being hazardous to public safety (hazard trees) and all standing dead trees should be cut and removed. Live trees with a 24-inch diameter breast height (dbh) size or greater should be left to add to the forest old growth component, unless they are considered a hazard. Pine species (especially sugar pine) and incense cedar should be favored as leave trees, with the resultant stand representing an uneven-aged forest, to the extent practical. Coarse woody debris (snags and down logs) should be retained as described in Table 4 in the *Coarse Woody Debris* section below, when available.

Ladder fuels should be removed as high as is safely possible, but no greater than one-fourth of the tree canopy will be removed. Most small diameter trees should be thinned, though small (1/5 acre) groups and individual trees in open areas should be retained to allow for the development of an uneven aged stand. All dead and decadent shrubs (shrubs with less than 50 percent foliar cover), all shrubs growing directly beneath the drip line of leave trees, and a minimum of 50 percent of the remaining live brush should be removed in a mosaic pattern to reduce horizontal fuel continuity.

Areas of active bark beetle infestation should be treated as a high priority for treatment and removed as soon as possible in order to reduce the impact from the insect, particularly in developed areas. Outbreaks of mistletoe should be evaluated using the Hawksworth Mistletoe Rating System (figure 20) in order to determine which trees should be targeted for removal. Preference should be given to prune branches infected with mistletoe over complete tree removal, if possible, particular in areas such as Sand Harbor where tree loss can significantly impact the character of the area. Trees with Hawksworth ratings greater than 3 should be removed, excepting when the Park Supervisor determines there are overriding scenic issues.

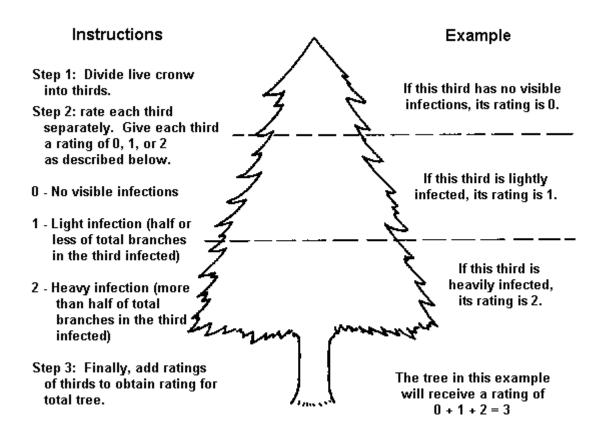


Figure 20. Hawksworth six-point mistletoe rating system.

Existing excess biomass and material generated from projects may be managed in several ways, depending up on site conditions and access. Pile burning is typically the most expeditious and cost effective in the backcountry. Chipping can be utilized as well, though this is usually only available along roads. When chipping, wood chips should be hauled off site, hauled to a central location, or broadcast on site. If broadcast, chip depth should not exceed four (4) inches in any one spot or vegetation re-growth may be reduced.

Fuel Breaks

The primary objective of a fuel break is to significantly reduce the threat of wildfire. Fuel breaks are typically designated within 150 feet of primary roads, campgrounds and significant structures

(e.g., Red House). Within fuel breaks, general forest management guidelines are applied, though nearly all snags are removed and basal area targets range from 60 - 120 square feet per acre, approximated by a tree spacing of 10 feet between crowns and 15 - 20 leave trees per acre. Up to three of the largest logs may be retained per acre, as described in the Coarse Wood Debris section of this document. Due to their location, chipping is preferred method of biomass disposal when available.

Aspen and Other Riparian Forests

Overstory removal methods may be employed to address both conifer encroachment and fuels reduction objectives. Over story removal treatment areas would cut and remove most conifers in a given area, and would be conducted in consultation with representatives from the Nevada Department of Wildlife (NDOW) and Nevada Division of Environmental Protection to ensure all appropriate resource protection measures are incorporated into the project. Overall project planning and implementation will be coordinated and approved by (as appropriate) staff from the State Historic Preservation Office (SHPO), NDOW, and the Nevada Division of Forestry (NDF) to ensure appropriate mitigation measures are in place to protect archeological, cultural, plant, and wildlife resources.

Cultural Zones

Directional felling and use of rigging where necessary is required in Cultural Areas to prevent damage to the resource. Pile burning may not occur within 100 feet of a flammable structure, or further if required by the Park Supervisor.

Park Development Zones

Trees may be retained at higher levels than described above to provide screening for campgrounds, restrooms, picnic areas, parking lots, and other facilities. Chipping and removal is the preferred biomass treatment method. Pile burning may be allowed in certain situations with approval from the Park Supervisor.

Disease Prevention

During all tree cutting, freshly—cut, live or recently dead, conifer stumps should be treated with a registered fungicide to prevent the establishment of annosus root disease.

Hazard Trees

A "hazard tree" is a tree with structural defects likely to cause failure of all or part of the tree, which could strike a "target." A target can be a vehicle, building, or a place where people gather such as a park bench, picnic table, street, or backyard. A target must be present in order for a hazard to exist

Hazard trees will be evaluated for removal based on their likelihood of failure and striking a target. Identified hazard trees will be immediately removed from the following areas:

- Park Development Zones campgrounds, parking lots, restrooms, picnic areas, etc.
- Structures with cultural significance (e.g., Red House, Hannah's Cabin)

Identified hazard trees will be monitored and removed if deemed appropriate in the following areas:

Roads and trails

Potentially hazardous trees located in other areas (backcountry, along user created trails) should generally not be managed.

Coarse Woody Debris

Fire, weather, insects, and disease create snags, and cavities are formed through natural decay and woodpecker excavation. Snags and coarse woody debris (CWD) provide a myriad of benefits to numerous wildlife species, including: cavity nesting sites, nesting platforms, sources of feeding substrate, plucking posts, singing or drumming sites, food cache or granary, courtship locations, over wintering sites, roosting, lookout posts, hunting and hawking perches, fledging sites, dwellings or dens, loafing sites, nesting under bark, communal nesting or nursery colonies, woodpecker anvil sites, and a thermally regulated habitat. Beyond their intrinsic value as standing dead trees, snags are also the source of logs on the ground and in streams, which play key ecological and geomorphic roles as well. Log sized residues may act as perched water tables, which provide niches for fungi to survive in and perhaps serve as nutrient reservoirs. More than 50 species of birds and mammals depend on snags for their survival and most holenesting birds are insectivorous and play an important role in forest pest control (e.g., bark beetles) in forests. The availability of suitable snags has been shown to be the limiting factor for populations of snag dependent wildlife.

Table 4 outlines retention standards for coarse woody debris in the park, utilizing the decay classes shown in figure 21. In general, clusters of snags will be retained, rather than individual stumps. Logs on contour will be favored over logs lying parallel to the slope when removal of some logs is appropriate to provide slope protection and increase plant establishment. Retained snags and logs should be distributed throughout all decomposition classes, as allowed by site conditions. Additionally, variability in species diversity should be considered when selecting snags and logs. In remote areas, consideration should be given to leaving jack-strawed log piles, especially where suitable pine marten habitat may occur. Coarse woody debris near sources of water are of higher value than dry sites.

Larger snags and logs are better, using >15" dbh and at least 60 feet high as a rule of thumb. When determining CWD quality for retention purposes, good snags are those that are 18" dbh with 40% bark cover; logs should be at least 12" -17" dbh and 20 feet long. Hardwoods provide more cavities than softwoods and all should be retained within stream environment zone buffer zones.

Table 4. Minimum retention standards for coarse woody debris.

Management Area	Snag Retention Standard	Log Retention Standard
Natural Areas	retain at least 2 of the largest non-hazardous snags per acre, all snags greater than 30" d.b.h., and all snags in decay classes 6 – 9 greater than 24" d.b.h.	retain at least 3 to 5 of the largest logs per acre in decay classes 1 - 3
Fuelbreak	None	Up to three logs greater than 16" dbh in decay class 2 or 3 per acre, if available
Riparian/Streamside	retain all non-hazardous snags greater than 16" dbh and all riparian snag species	retain all logs greater than 16" diam and 20 feet long
Non-stream SEZ	retain all non-hazardous snags greater than 16" dbh and all riparian snag species	retain all greater than 16" diam and 20 feet long
Shorezone	retain all non-hazardous snags greater than 16" dbh.	retain all logs greater than 16" diam and 20 feet long

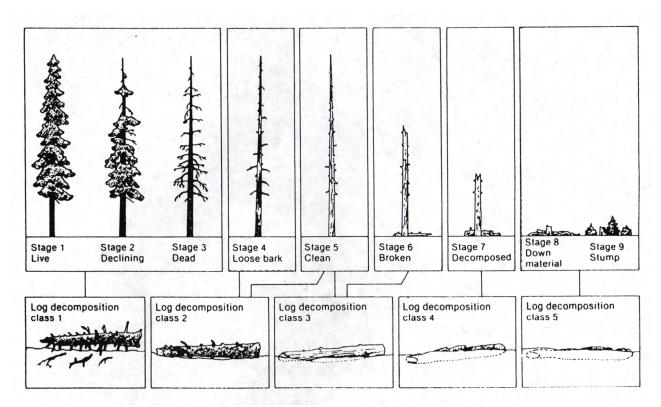


Figure 21. Snag and log decomposition classes (Maser and Trappe, 1984).

Prescribed Fire

The safe re-introduction of fire into the ecosystem is promoted in appropriate areas of the park. Broadcast burning projects will be considered by the park supervisor to reduce surface fuels and restore the fire-adapted ecosystem following initial treatments designed to reduce the overall accumulation of biomass and threat of destructive crown fires (see Forest Management guidelines). Prescribed fire projects will first focus on reducing heavy surface fuel loads and then on restoring and maintaining the natural fire regime where possible, typically on a 5-12 year fire return interval for low intensity surface fires.

Roads and Trails – Prescribed fire projects will typically utilize roads and trails as natural burn unit delineations. Within 100 feet of roads and trails, pre-fire activities will be implemented to reduce the visual impacts from the fire. This may include the construction of fire lines around larger (>24" dbh) trees and ensuring that surface fuels will not result in scorching of limbs. Some basal scorching will be allowed in conjunction with interpretive signing to describe the importance of fire in the ecosystem.

Cultural Zones – The use of prescribed fire, including broadcast and pile burning, is prohibited within 100 feet of structures in Cultural Areas to prevent damage to the resource. Fire lines shall be constructed completely around structures or resources and the use of foam may be necessary as well.

Wildlife

To minimize impacts to wildlife from activities or project, the following guidelines will be followed in all management zones, except in Park Development management zones where, implementation of the guidelines will be at the Park Supervisor's discretion. The Tahoe Regional Planning Agency or the Nevada Department of Wildlife may have additional restrictions and should be consulted prior to project implementation. When proposing projects, priority is given to the needs of threatened and endangered species and their associated habitat. Consultation with an NDOW biologist or completion of a biological review will determine if suitable habitat is present for sensitive species.

Limited Operating Periods (LOP)

Implementation of projects in riparian and brush areas should be completed outside of the breeding bird season, generally April to mid-July. Active and recently abandoned (within the last three years) nest trees should be retained and undisturbed unless deemed hazardous (see hazard trees section of this document).

In suitable habitat, a northern goshawk LOP should be maintained during the breeding season (February 15 – September 15) for activities that may disrupt breeding within ¼ mile of a nest site or activity center, unless wildlife surveys confirm that goshawks are not nesting. When the location of the nest site or activity center is uncertain, surveys should be conducted to establish or confirm the location prior to implementing activities.

A California spotted owl LOP should be maintained during the breeding season (March 1 – August 15) for activities that may disrupt breeding within ½ mile of the nest site or activity

center, unless surveys confirm that spotted owls are not nesting. The LOP may be waived for vegetation treatments of limited scope and duration, when a biological review determines that such projects are unlikely to result in breeding disturbance considering their intensity, duration, timing and specific location.

For the bald eagle nesting areas at Marlette Lake, a limited operating period (LOP) should be maintained during the breeding season (March 1 through August 31) for activities that may disrupt breeding within 1/2 mile of the nest(s) unless surveys confirm that bald eagles are not nesting.

Within 500 feet of known occupied mountain yellow-legged frog habitats, pesticide applications should be designed to avoid adverse effects to individuals and their habitats.

A willow flycatcher LOP should be maintained during the breeding season (June 1 – August 31) for activities that may disrupt breeding within ¼ mile of occupied nest sites or habitat. Generally, suitable habitat consists of the presence of 10 acres or more of continuous stands of willow.

A pine marten LOP should be maintained during the breeding season (May 1 - July 31) for activities that may disrupt breeding within 100-acres of known den sites.

A mountain beaver LOP should be maintained during the breeding season (December 15 – March 31) for activities that may disrupt breeding within ½ mile of known nest sites.

A Townsend's big-eared bat LOP should be maintained year-round except October 1-31 for activities that may disrupt this species life history requirements within ½ mile of known sites.

Control

Bears occur throughout the park and should not be controlled unless they pose a threat to visitors or staff. The park should actively work to reduce and, where possible, eliminate wildlife access to human food and garbage by using wildlife-resistant food and waste receptacles where appropriate, including development zones and trailhead locations. Additionally, activities to educate the public about the detrimental effects that supplanting wildlife food sources with human food can have on the ecological balance of the park and surrounding regions should be promoted.

Beavers may be found in streams within the park. Unless significant resource damage is occurring, beavers will not be removed and may provide ecosystem benefits in degraded drainages.

Vegetation

Wildflower Collecting

The removal of herbaceous vegetation ("wildflower collecting") is not allowed within the park.

Tahoe Yellow Cress

Existing Tahoe yellow cress (TYC) populations within the park are located in currently high-use areas, including Sand Harbor and Cave Rock. As such, management protection of these small populations is difficult, but typical uses do not represent a threat to the metapopulation dynamic of the species. Beyond existing visitor use, additional disturbances to these populations of Tahoe yellow cress should be avoided, if possible. Experimental populations of TYC to support research efforts may be established with approval from the Park Supervisor.

Revegetation

Revegetation projects, including fire rehabilitation areas, riparian restoration projects, trail closures, reclamation, and project mitigation work should generally utilize seed stock and containerized plantings from native species found within the park. A species list for each project, preferably using the TRPA List of Approved Plant Species, should be reviewed and approved by NDOW to ensure species appropriateness and to reduce the possibility of introducing noxious weeds. Revegetation activities should follow the guidelines established in the "Objectives for Revegetation Projects Within NV Tahoe State Parks" (Appendix D). This document outlines preferred approaches to revegetation projects, site preparation, mulching, and suggested maintenance routines.

Terrestrial Invasive Species

The introduction of non-native species to Lake Tahoe Nevada State Park is prohibited in order to protect resources. Parks works with and follows the guidelines established by the Lake Tahoe Basin Weed Coordinating Group (LTBWCG) through a Memorandum of Understanding (MOU) to manage invasive weeds. The LTBWCG establishes and reviews a list of priority invasive weed species annually, and recommends management strategies. To support the effort to control and reduce the opportunity for invasive weeds to spread, the following guidelines should be followed for projects being implemented within the park:

- Mud, dirt, and plant parts must be removed from all off road vehicles and equipment before entering the park. This does not apply to service vehicles that will stay on the roadway, traveling frequently in and out of the park;
- Mulch, straw, seeds, and similar vegetative material used in projects for mitigation, revegetation, etc., must be certified weed free, and;
- Disturbed soil, except the travel way on surfaced roads, should be revegetated in a
 manner that optimizes plant establishment for that specific site, unless ongoing
 disturbance at the site will prevent weed establishment. A seed mix that includes fast,
 early season native species should be used to provide quick, dense revegetation. To avoid
 weed contaminated seed, each lot must be tested by a certified seed laboratory against the
 all State noxious weed lists and documentation of the seed inspection test provided.

Aquatic Invasive Species

Parks is also a cooperative partner with the Lake Tahoe Basin Aquatic Invasive Species Working Group (AISWG) through an MOU to cooperate and coordinate activities necessary to prevent the introduction, establishment, and spread of non-native aquatic species in the Lake Tahoe Basin. No guidelines have been explicitly developed for the park since TRPA has established regulations through its Vessel Inspection Program. The program is designed to help prevent the introduction of new aquatic invasive species (AIS) populations in the Tahoe Region, to control those populations that already exist and to prevent degradation to Thresholds, mainly Recreation and Fisheries. The program requires that qualified boat inspectors must be available to inspect vessels prior to launch at all launch facilities. Support from the park has included the installation of infrastructure such as boat ramp gates at Sand Harbor and Cave Rock to prevent launching when inspectors are not present and educational outreach through signage.

Water Quality

Protection of water quality for all water bodies and streams within the park is one of the highest priorities for parks management. In order to maintain or improve upon current water quality, the *TRPA Handbook of Best Management Practices* should be reviewed and applicable BMP's incorporated for all park projects within and outside of the basin.

Cultural Resources

Historic resources, including structures, sites, and roads, will be protected from the impacts of implementing other projects through the use of flagging and avoidance. Prior to the implementation of any project, consultation with SHPO will occur to determine mitigation and avoidance measures. Flagging and avoidance includes structures, sites, and aspen arborglyphs.

Existing archeological and historic resources will be maintained in a state of "arrested decay." As funding mechanisms are developed, appropriate restoration projects will be implemented to preserve or repair these features.

Utilities

To protect park resources, the following guidelines should be followed when approving special use permits for utilities:

- Avoid construction activities in wetlands and meadows and minimize stream crossings;
- Clear only the minimum area required for safe transmission line use
- Utilize existing access roads to the greatest extent possible, except when the relocation of a portion of road would result in a net environmental benefit or fix an existing problem;
- Locate utility easements to minimize impacts to and away from key scenic resources, including ridgelines, campgrounds, lakes, and prominent rock outcrops.
- Minimize damage to trees from equipment by requiring the following tree protection measures:

- Tree roots four inches in diameter and larger encountered during excavation of utility trenches should not be severed, if avoidable.
- o All tree roots four inches in diameter or larger severed during excavation shall be cut flush with the surface of the excavation.
- o Fencing shall be placed at a minimum along the dripline of the tree(s) unless an alternative placement is approved

Projects

Corrective actions are necessary to address physical resource problems within the park. These include removing (where feasible) portions of roads and trails located in wet areas, implementing permanent Best Management Practices (BMPs) to control erosion and improve water quality, minimizing the presence of human infrastructure in the backcountry, and maximizing scenic vistas. All projects should include an interpretive element that includes sign usage conforming to uniform standards, primarily the *Nevada State Parks Design Standards for Interpretive Panels* and the *Lake Tahoe Recreation Sign Guidelines* developed by the Tahoe Coalition of Recreation Providers (TCORP).

In 1997, the Lake Tahoe Presidential Summit was held at Sand Harbor that focused national attention on the resource problems of Lake Tahoe, fostered the partnership between federal, state, local, and private entities, and initiated the Environmental Improvement Program (EIP). The EIP is comprised of approximately 700 capital improvement and research projects that are designed to reduce the effects of accelerated erosion, enhance the ecology of the basin, improve water quality, and enhance recreation opportunities. Nevada has committed \$82 million to the program and formed the multi-agency Nevada Tahoe Resource Team to oversee project

implementation.

Within the Lake Tahoe basin portion of the park, projected needs to address resource problems are expressed in the Environmental Improvement Program (EIP). Outside of the Tahoe basin, a comprehensive inventory is needed to identify impacts to resources and prioritize restoration projects. Projects described within this chapter should be further defined through coordination with Parks Planning and Development and other appropriate resource agencies.



Specific physical resource management needs are listed below; however, additional needs may be identified through the implementation of comprehensive assessments.

Soil and Water Resource Projects

- North Canyon/Tahoe Rim Trail Connector Upgrade Improve and re-align existing connector trail from North Canyon to Tahoe Rim Trail to reduce steep grade. May include additional signage.
- Lake Tahoe Nevada State Park Road and Trail Sustainable Design Assessment Access and travel management program to upgrade existing trails, where necessary, within Lake Tahoe Nevada State Park to provide sustainable design in support of regional thresholds. May include improvement of drainage crossings, erosion control and stablization on road cuts, recontour of trails and re-direction of problem segments, etc. Along with forest management, the development of an overall Trail Management Plan for the park should be considered a high priority. Completion of a *Lake Tahoe Nevada State Park Road and Trail Sustainable Design Assessment* would provide an

assessment of the current state of roads and trail within the park; provide suggestions for upgrades, closures or conversions, a framework for new trail corridors, and an annual maintenance schedule and standards

- Implementation of Road and Trail Sustainable Design Assessment
- Spooner Log Landing Restoration rehabilitiation of the log landing located outside of the Tahoe basin. May include partial or full recontouring of landing area and revegetation for soil stabilization, and native plant establishment. Could include installation of gate near entrance to prevent unauthorized vehicle access.
- North Canyon Road and Crossing Improvements implementation of improvements to existing crossings as identified in Road and Trail Assessment in North Canyon. The North Canyon Creek Restoration Project [2010] recommended that a management road sustainability plan be developed. The report suggests traffic on management roads consists primarily of mountain bicycles, which over the summer season loosens the road surface. Active erosion has been noted in the mid canyon and there is concern that the road could wash out. The focus of this restoration strategy is to manage these sources of sediment available for transport to the surface water system through the development of a road management strategy that includes repairs, improvements, and annual maintenance requirements.
- Tunnel Creek Road and Crossing Improvements implementation of improvements to existing crossings as identified in Road and Trail Assessment in the Tunnel Creek watershed.
- State Route 28 Erosion Control and Access Project, Phase 3 Stabilize existing trails and areas of excessive erosion along State Route 28 throughout the parks shoreline boundary. Priority areas include, but are not limited to, that portion of the park south of Sand Harbor and Hidden Beach. May include closure of user-created trails and construction of connecting trail between Memorial Point and Hidden Beach with lake access spurs.
- Sand Harbor Boat Parking Water Quality Enhancement Improvement of Sand Harbor boat parking facility including re-configuration of parking spaces to better accommodate users, modification of entrance to improve traffic flow; extension of existing boat ramp for low-water launching; and the installation of water quality treatment measures.
- Spooner Dam Outlet Retrofit and Management Plan Development of retrofit and management plan for Spooner Lake dam outlet as proposed in 2002 North Canyon Watershed Assessment. Includes new valve and gate control, and a weir structure to gauge outlet flows.
- Spooner and Marlette Water Quality Monitoring Program and Assessment development of a program to monitor specific water quality parameters at Marlette and Spooner Lake to inform management.
- Implementation of Spooner and Marlette Water Quality Assessment Recommendations.

- Spooner Meadow Recreation Management Plan Compacted cross country ski trails
 and improperly installed stream crossings have resulted in poor vegetation growth and
 channel erosion in discrete locations within meadow. Develop recreation management
 plan for meadow, possibly including removable bridges and annual rotation of
 recreational paths.
- North Ditch Plug And Pond Multiple channel plugs will be installed using on-site material to intentionally raise water surface elevations and divert flows out of the current North Ditch channel and onto the meadow surface in the northern portion of Spooner Meadow. Flows can be directed into either remnant feeder channels used to historically irrigate the meadow or other low areas to allow flows to find their own path. Areas excavated to provide plug material will pond with groundwater and create habitat diversity within the meadow ecosystem. This strategy is intended to work with the existing channel plan-form and utilize on-site materials to redirect flows and is more cost-effective and less intensive than constructing a new stream channel.
- South Ditch Abandonment Spooner Lake flows will be redirected into the remnant channel within Spooner Meadow through culvert replacement at the management road and the South Ditch will be abandoned. Remnant channel alignment is not anticipated to change and only minor grading will occur within the channel. Riparian vegetation will be planted adjacent to remnant channel to enhance habitat conditions and ensure bank stability. Dewatering and flow diversions can likely be avoided by temporarily closing the Spooner Dam outlet controls and utilizing the South Ditch for flows while working in remnant channel. Once flow has been redirected into remnant channel, the South Ditch will be backfilled and stabilized with ground cover. Existing culverts at the management road will be replaced with a single larger culvert. It is recommended that the new culvert be placed in such a manner to create an intentional fish passage barrier for upstream migration to prevent fish mortality due to stranding during reduced flows. Additionally, aspen plantings at the site of South Ditch will improve transitional habitat and increase recreational value of the area.
- Bank Stabilization Downstream Of Confluence Bio-engineering bank stabilization techniques will be applied to specific locations on North Canyon Creek downstream of the confluence in Spooner Meadow. Minor grading, willow plantings, harvested sod matting, and other native materials may be utilized to improve bank stability. Riparian plantings will be extended beyond the banks in some locations to encourage establishment of a riparian buffer.
- Spooner Dam Release Modifications Spooner Dam storm flow releases can be improved to increase hydrologic disturbance to meadow system. A refined release strategy and/or modified spillway or riser structure can help automate storm releases and alleviate significant management by personnel.

Scenic Resource Projects

• Cave Rock Water Quality and Scenic Enhancement - Design and implementation of enhancements to Cave Rock parking area, including new curb, sidewalk re-alignment, upgraded VIP site, stormwater treatment enhancement, and parking spot re-striping to accommodate longer boat parking). Also includes interpretive component for Cave

Rock, possible installation of a retaining wall to widen parking, picnic shade covers, new tables, and new grills.

Specific biologic resource management needs are listed below; however, additional needs may be identified through the implementation of comprehensive assessments. Corrective actions necessary to address biotic resource problems within the park include the implementation of vegetation management activities to reduce the threat of wildfire and increase biological integrity in upland and riparian forests, stream stabilization and restoration projects to return geomorphic function and improve aquatic habitat, and invasive species management:

Vegetation Resource Projects

- Invasive Weed Assessment and Management Program Conduct a park-wide assessment and inventory of the current status and impact of invasive weeds, and develop a management plan to address issues. Implement projects within LTNSP to accomplish management plan.
- Park-wide forest restoration and fuels reduction activities, including the implementation of the East Slope Forest and Fuels Management Plan (Appendix K) and EIP Forest Restoration and Old Growth Improvement programs. East Slope Forest and Fuels Management Plan projects include:
 - East Slope Fuels Reduction (Complete)
 - Franktown Creek Riparian Enhancement
 - Franktown Creek Fuels Reduction
 - Hobart Reservior Fuels Reduction
 - Lakeview Road Brush Management
 - Marlette Peak Forest Improvement
 - Spooner Summit Fuels Reduction
- Sand Harbor Vegetation Management Development and implementation of a
 vegetation management plan for Sand Harbor, which may include control of mistletoe
 infestations, SEZ enhancement through conifer removal, invasive weed management,
 as well as an interpretive component for native vegetation similar to demonstration
 gardens.
- LTNSP Fuel Break Maintenance Program outline of activities needed to maintain fuel break areas within the park, with prescriptions and rotation intervals.
- Rare/Threatened/Endangered plant inventory and management program

Wildlife Resource Projects

- North Canyon "Grand Canyon" Restoration implementation of measures to stabilize eroding banks, including revegetation.
- Spooner Meadow Stream Function Restoration implementation of measures to improve floodplain function, riparian vegetation, and fish habitat.

- Park-wide Riparian Community Restoration (including aspen restoration and mountain beaver habitat improvement projects)
- LTNSP Old Growth Inventory and Management Program inventory, mapping, and assessment of Late Successional/Old Growth forest stands within the park and management program. Inventory will establish definition of what constitutes old growth forest stands (minimum stand size, numbers and diameter minimums of large trees per acre, numbers of down logs, canopy closure minimum, etc.) and utilize existing vegetation map to identify potential stands for field verification;
- Spooner Lake ADA Wildlife Viewing Platform ADA accessible platform extending over Spooner at the west end of the lake in the vicinity of the dam.
- Additional wildlife resource enhancement projects identified by ID teams

Fishery Resource Projects

- Franktown Creek Stream Stabilization project will address significant headcutting and unstable banks along Franktown Creek from Hobart Reservoir northward to the LTNSP border.
- Additional fishery resource enhancement projects identified by ID teams

In general, cultural resources should be avoided during the implementation of management activities to prevent damage or loss. Forest restoration activities should also benefit structures of historical significance through removal of the potential for damage from standing dead trees and excess biomass. However, direct restoration activities are needed in the immediate future as well to prevent the loss of historic structures located within the park, including the MLWS and associated structures and sites. Additionally, a cohesive interpretive program is necessary to foster a sense of stewardship and encourage the preservation of these resources. Specific archeological and historic resource management needs are listed below; however, additional needs may be identified through the implementation of comprehensive assessments.

Cultural Resource Projects

- Develop an inventory, GIS mapping system, and database for those cultural resources within the Park that may be eligible for inclusion in the National Register of Historic Places and/or the California Register of Historic Resources.
- Comprehensive Park-wide Historic and Heritage Interpretation Program review of existing interpretive information and panels within the park, determine missing elements, and finalize a cohesive plan that can be implemented as funding becomes available and includes both interpretive signage, programs designed to deliver specific messages, and the use of technology (e.g., podcasts, recorded nature walks, or interactive displays).
- Marlette Lake Water System Interpretation review of existing interpretive information and panels within the park, determine missing elements, and develop a comprehensive interpretative sign plan that can be implemented park-wide.

- Hannah's Cabin Restoration development of a primary planning document to guide decision-making about preservation, rehabilitation, restoration, or reconstruction treatments, and a budget and schedule planning for work on the historic structure. Plan should also include a compilation of key information on the history, significance, and existing condition of the cabin. Will include implementation of recommendations as funding becomes available. Priority for immediate stabilization due to continued deterioration and potential for vandalism.
- Red House Restoration development of a primary planning document to guide decision-making about preservation, rehabilitation, restoration, or reconstruction treatments, and a budget and schedule planning for work on the historic structure. Plan should also include a compilation of key information on the history, significance, and existing condition of the cabin. Will include implementation of recommendations as funding becomes available. **Priority for immediate stabilization due to continued deterioration and potential for vandalism.**
- Sawmill Boiler Site Study comprehensive review of historic records to research and compile site specific history of sawmill boiler located along Lakeview Road.
- East Slope Archeological Resource Inventory and Evaluation Conduct a comprehensive pre-European and Comstock-era study of the eastern portion of the park outside of the Tahoe basin to include extensive field work, similar in scope to "Archeological Survey of 2,489 Acres in Lake Tahoe Nevada State Park" in 2001. Research and evaluation should tie into specific park sites (e.g., Tunnel Creek station, MLWS maintenance stations, etc.), identify what resources exist, what needs to be protected, and what resources may be National Historic Registry eligible.

Inventory and Monitoring

The purposes of the monitoring program are to:

- measure changes resulting from the implementation of projects
- determine if project objectives have been met
- ensure that no negative impacts to the environment are resulting from project implementation, and
- provide information that may be used to improve projects in the future.

The table below lists the different monitoring activities that can be undertaken to monitor change within the park ecosystem and movement towards desired project goals. Point count stations, sample plots, and transects should be GPS'd where appropriate.

Table 5. Monitoring activities.

PROJECT SPECIFIC MONITORING

Measure	Purpose	Methods	Frequency		
	General Projects				
Photo Points	Photo monitor changes in project sites over time	Establish pre and post project photo monitoring sites (potentially follow modified protocols described in USFS Tech Report, PNW-GTR-526)	Pre and 1-, 3-, 5-, and 10- yr post project		
	Riparian Enhancement Projects				
Songbirds	Detect changes in species abundance and diversity	Conduct point counts along riparian corridor to determine changes in numbers and species diversity in riparian songbird species.	Annual (spring)		
	Stream/Meadow/Fish Habitat Restoration Projects				
Macroinvertebrates	Indicator of overall stream health and instream habitat	Rapid bioassessment protocols adopted by LRWQCB/SNARL.	Annually during summer		
Stream Bed Material	Detect changes in stream bed composition, and therefore fish spawning substrate	Wollman Pebble counts	1 st year before and after a project; then periodically		

Measure	Purpose	Methods	Frequency
Stream Channel Cross Sections	Determine change in channel cross section as a result of the project to allow inference of changes in hydraulics and geomorphic response	Using transit and Auto Level, establish new (or re-measure existing) permanent channel cross sections in areas that will be modified by the project.	1 st year before and after a project; then periodically
Groundwater Observation Wells	Record and graphically depict changes in shallow subsurface water levels resulting from changes in stream channel morphology	Installation of screen PVC pipes along transects perpendicular to stream channel. Record water levels in pipes.	1 – 2 years before and after project. Collect data weekly April – June, then monthly
Fish Species	Detect changes in abundance and diversity	Conduct species counts using established methods from NDOW	Annual
Forestry Projects			
Basal Area (BA)	Determine if project implementation attains RM Guidelines for BA	May be estimated using 10 or 20 BAF prisms	Pre and post project

CONTINUOUS AND ON-GOING MONITORING

Measure	Purpose	Methods	Frequency	
Basin-wide Data Support				
TYC	Monitor changes in population size relative to project activities	Follow protocols established in TYC Conservation Plan as part of annual survey. Includes Sand Harbor, Hidden Beach, and Cave Rock Management Units.	Annual	
Secchi Disk	Marlette and Spooner Lakes	Collect data as part of North American Secchi Dip In	Annual (summer)	
Park-wide Data Collection				

Measure	Purpose	Methods	Frequency
Trail Condition	Determine maintenance needs for trails, interpretive signage, and associated trailhead infrastructure	Follow TRT established trail maintenance needs protocols until Trail Management Plan is complete for park.	Annual (spring/summer)
Trail Use	Monitor general visitor use levels of trails	Install active infrared trail monitor equipment near trailhead. Monitor use over desired time frame.	Every three years on higher use trails, or as neeeded
Historic Structure Condition Survey	Evaluate current condition of historic structures	Provide brief report of staff inspection of each significant structure identifying immediate management needs.	Annual (spring/summer)
Fish and wildlife	Determine status and trend of target fish and wildlife species within the park, including raptors, pine marten	Completed by NDOW staff	Annual

Inventory and Data Gaps

Inventories of natural and cultural resources have been completed to varying degrees and in many sections of the park. Generally, these inventories are completed by other agencies, usually as part of the environmental documentation for a specific project. Some of these have been collected by parks staff and are found in the appendices of this document.

It is essential that the park be more fully inventoried to better understand the complexity of its cultural resources, and to make appropriate management decisions that may affect those resources. Cultural resources inventories are particularly needed in many portions of the park, since most archeological survey work conducted in the park is a result of Section 106 compliance requirements.

An historical overview and assessment is needed to synthesize the historical data to provide a contextual history on the development of the park's structures. Cultural resources also need to be evaluated for listing in the National Register of Historic Places, and monitoring programs need to be developed for listed or eligible sites and structures.

Vegetation is generally well documented throughout the park through general sources (e.g., Lake Tahoe Watershed Assessment), plant lists from field trips, and remote sensing data. However, a more systematic botanical survey of the park focused on rare, threatened, and endangered plants should be completed in order to better inform management, particular in wet areas and high elevations. Similarly, old growth areas in the eastern portion of the park should be field

identified, using agreed upon definitions for forest types, and mapped for future priority management.

Data Management and GIS

The Nevada Tahoe Resource Team utilizes existing and user-created GIS data for analysis, tracking, reporting, permitting, and graphic displays. This *NTRT GIS Procedures Manual* establishes guidelines and procedures designed to ensure that all NTRT members can:

- have access to all applicable GIS data;
- be assured that the data they are accessing is the most current and accurate;
- be able to identify basic information regarding the data sources (i.e., metadata);
- more easily respond to graphic data requests (greater team meetings, EIP updates, etc.), and;
- easily communicate to new team members how data are organized.

The manual is intended to be a dynamic document that is updated frequently to reflect changes in procedures and structure. As such, the manual is centrally stored electronically in the main NTRT GIS (G:\TAHOE\GIS_Procedures_Manual_NTRT). Parks staff will likewise maintain GIS data in this directory and following these procedures.

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Appendices

Appendix A – List of Park Map Quadrangles

Appendix B – Soils and Descriptions

Appendix C – Vegetation List

Appendix D - Objectives for Revegetation Projects Within NV Tahoe State Parks

Appendix E – Insects and Diseases List

Appendix F – Birds, Mammals, Fish, and Herptiles List

Appendix G – Nutrient Concentrations for Marlette and Spooner Lakes, 2002 -2003

Appendix H – Inventory of Significant Historic Resources

Appendix I – Additional Coarse Woody Debris Considerations for species

Appendix J – Maps

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Appendix K – East Slope Forest Management Plan

Appendix L – Nevada Tahoe Resource Team GIS Procedures Manual

Appendix M – State Parks Policy 35-2, Special Area Designations

Appendix N – Minimum Impact Suppression Tactics (MIST) for Wildland Fire Suppression

Appendix A - List of Park Map Quadrangles

USGS 7.5 series topographic maps covering Sand Harbor, Spooner, and Highway 28 Management Areas:

Marlette Lake Quadrangle (Nevada)

T16N & R18E sections 25, 26, 35, 36

T16N & R19E sections 29, 30, 31, 32

T15N & R18E sections 1, 2, 12, 13, 24, 25, 35, 36

T15N & R19E sections 5, 6, 7, 8, 17, 18, 19, 30

Carson City Quadrangle (Nevada)

T16N & R19E sections 28, 29, 32, 33, 34

T15N & R19E sections 3, 4, 5, 8, 17

Glenbrook Quadrangle (Nevada)

T15N & R18E sections 34, 35, 36

T14N & R19E section 6

USGS 7.5 series topographic maps covering Cave Rock Management Area:

Glenbrook (Nevada) Quadrangle

T14N & R18E, section 27

USGS 7.5 series topographic maps covering Van Sickle Management Area:

South Lake Tahoe (California-Nevada) Quadrangle:

T13N & R18E, sections 25, 26, 27, 34, 35

Appendix B – Table of Soil Types and Associated Properties

Table 1. Soil types within Lake Tahoe Nevada State Park.

Soil Type	MUSYM	Description
	Code	
Cagwin gravelly sand, 15 to 30% slopes	0006	The Cagwin component makes up 100 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains, mountain slopes. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Toem-Rock outcrop complex, 50 to 75 percent slopes	0066	The Toem component makes up 60 percent of the map unit. Slopes are 50 to 75 percent. This component is on mountains, mountain slopes. The parent material consists of residuum derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 8 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Toiyabe-Corbett complex, 30 to 50 percent slopes	0067	The Toiyabe component makes up 55 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains, mountain slopes. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		The Corbett component makes up 25 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is

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		7e. This soil does not meet hydric criteria.
Toiyabe-Rock outcrop complex, 30 to 50 percent slopes	0068	The Toiyabe component makes up 75 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Temo-Witefels- Rock outcrop association	0106	The Temo component makes up 50 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 8 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		The Witefels component makes up 20 percent of the map unit. Slopes are 30 to 70 percent. This component is on mountains. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Toiyabe, bouldery- Rock outcrop complex, 50 to 70 percent slopes	0107	The Toiyabe component makes up 80 percent of the map unit. Slopes are 50 to 70 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Soil Type	MUSYM Code	Description
Witefels-Rock outcrop complex, 4 to 15 percent slopes	0161	The Witefels component makes up 85 percent of the map unit. Slopes are 4 to 15 percent. This component is on mountains, mountain slopes. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Witefels-Rock outcrop complex, 30 to 50 percent slopes	0163	The Witefels component makes up 70 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes, mountains. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Blackwell sandy loam	0740	The Blackwell component makes up 85 percent of the map unit. Slopes are 0 to 4 percent. This component is on flood plains, mountains. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 15 inches during March, April, May, June, July. Organic matter content in the surface horizon is about 5 percent. This component is in the R026XY003NV Wet Meadow 10-14 P.z. ecological site. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.
Toiyabe-Corbett- Rock outcrop association, moderately steep	0752	The Toiyabe component makes up 40 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		The Corbett component makes up 35 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root

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		restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Toiyabe-Corbett- Rock outcrop association, steep	0753	The Toiyabe component makes up 55 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		The Corbett component makes up 20 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Toiyabe-Rock outcrop complex, 50 to 70 percent slopes	0754	The Toiyabe component makes up 80 percent of the map unit. Slopes are 50 to 70 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Marla loamy sand, 0 to 4 percent slopes	0821	The Marla component makes up 90 percent of the map unit. Slopes are 0 to 4 percent. This component is on alluvial fans, intermontain basins. The parent material consists of alluvium derived from granitic rocks. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This

Soil Type	MUSYM	Description
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		soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, May, June. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil meets hydric criteria.
Temo-Witefels- Rock outcrop association	0840	The Temo component makes up 50 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 8 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		The Witefels component makes up 20 percent of the map unit. Slopes are 30 to 70 percent. This component is on mountains. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Temo-Witefels- Rock outcrop association	0934	The Temo component makes up 50 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains, mountain slopes. The parent material consists of residuum and colluvium derived from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 8 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.
		The Witefels component makes up 20 percent of the map unit. Slopes are 30 to 70 percent. This component is on mountain slopes. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72

Soil Type	MUSYM	Description
	Code	
		inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Rock outcrop	0990	Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.
Gabica very gravelly sandy loam, 8 to 30 percent slopes	1010	The Gabica component makes up 85 percent of the map unit. Slopes are 8 to 30 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from volcanic rocks. Depth to a root restrictive layer, bedrock, lithic, is 14 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the R026XY028NV Mountain Ridge ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Witefels-Rock outcrop complex, 15 to 30 percent slopes	1060	The Witefels component makes up 70 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountains, mountains. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Witefels-Rock outcrop complex, 50 to 70 percent slopes	1062	The Witefels component makes up 70 percent of the map unit. Slopes are 50 to 70 percent. This component is on mountains, mountains. The parent material consists of residuum weathered from granitic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Inville variant gravelly sandy loam, 2 to 8	1080	The Inville variant component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on mountains, mountains. The parent material consists of mixed alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is

Soil Type	MUSYM	Description
	Code	
percent slopes		moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 30 inches during January, February, March, April, May, June. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 6w. Irrigated land capability classification is 4w. This soil does not meet hydric criteria.
Apmat gravelly sandy loam, 2 to 8 percent slopes	1121	The Apmat component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on mountains, mountains. The parent material consists of mixed alluvium, dominately derived from glacial till. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
Tallac very bouldery sandy loam, 4 to 30 percent slopes	1440	The Tallac component makes up 85 percent of the map unit. Slopes are 4 to 30 percent. This component is on mountains, mountains. The parent material consists of glaciomarine deposits. Depth to a root restrictive layer, duripan, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Tallac stony sandy loam, 30 to 50 percent slopes	1441	The Tallac component makes up 85 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains, mountains. The parent material consists of glaciomarine deposits. Depth to a root restrictive layer, duripan, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Jorge-Boomtown- Fugawee association	1460	The Jorge component makes up 35 percent of the map unit. Slopes are 15 to 50 percent. This component is on mountains, mountains. The parent material consists of residuum and colluvium derived from volcanic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 50 to 98 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic

Soil Type	MUSYM	Description
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		matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
		The Boomtown component makes up 30 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountains. The parent material consists of residuum and colluvium derived from volcanic rocks. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.
		The Fugawee component makes up 20 percent of the map unit. Slopes are 15 to 50 percent. This component is on mountains. The parent material consists of residuum and colluvium derived from volcanic rocks. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 6 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
7041—Tahoe complex, 0 to 2 percent slopes	7041	The Tahoe, silt loam component makes up 55 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains, valley flats, mountains. The parent material consists of alluvium derived from granitic and volcanic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is occasionally flooded. It is occasionally ponded. A seasonal zone of water saturation is at 6 inches during March, April, May. This component is in the R022AE208CA Frigid Loamy Terrace ecological site. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.
		The Tahoe, silt loam wet component makes up 25 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains, valley flats, mountains. The parent material consists of alluvium derived from granitic and volcanic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 4 inches during March, April, May. Organic matter content in the surface horizon is about 18 percent. This component is in the R022AE203CA Frigid Loamy Floodplain ecological site. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.

Soil Type	MUSYM Code	Description
Watah peat, 0 to 2 percent slopes	7071	The Watah, sedges component makes up 75 percent of the map unit. Slopes are 0 to 2 percent. This component is on fens, flood plains, valley flats, mountains. The parent material consists of organic material over alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is frequently flooded. It is frequently ponded. A seasonal zone of water saturation is at 4 inches during March, April, May. Organic matter content in the surface horizon is about 80 percent. This component is in the R022AE209CA Flooded Basins ecological site. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.
Deerhill gravelly fine sandy loam, 9 to 30 percent slopes, very stony	7111	The Deerhill component makes up 80 percent of the map unit. Slopes are 9 to 30 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from metavolcanics. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE023CA Pinus Jeffreyi/arctostaphylos Patula-Ceanothus Cordulatus/elymus Elymoides ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Southcamp very gravelly fine sandy loam, 50 to 70 percent slopes	7211	The Southcamp component makes up 80 percent of the map unit. Slopes are 50 to 70 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from volcanic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE013CA Abies Concolor-Pinus Lambertiana/quercus Vacciniifolia-Amelanchier Utahensis/pyrola Picta ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Zephyrcove- Southcamp- Genoapeak complex, 9 to 30 percent slopes	7241	The Zephyrcove component makes up 50 percent of the map unit. Slopes are 9 to 30 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from trachyte. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the

Soil Type	MUSYM	Description
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		F022AE021CA Pinus Jeffreyi/purshia Tridentata-Arctostaphylos Patula ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Cagwin-Rock outcrop complex, 5 to 15 percent slopes, extremely stony	7411	The Cagwin component makes up 50 percent of the map unit. Slopes are 5 to 15 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over grus derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE021CA Pinus Jeffreyi/purshia Tridentata-Arctostaphylos Patula ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
Cagwin-Rock outcrop complex, 15 to 30 percent slopes, extremely stony	7412	The Cagwin component makes up 50 percent of the map unit. Slopes are 15 to 30 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over grus derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE021CA Pinus Jeffreyi/purshia Tridentata-Arctostaphylos Patula ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Cagwin Rock outcrop complex, 30 to 50 percent slopes, extremely stony	7413	The Cagwin component makes up 50 percent of the map unit. Slopes are 30 to 50 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over grus derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE021CA Pinus Jeffreyi/purshia Tridentata-Arctostaphylos Patula ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Cagwin-Rock outcrop complex, 50 to 70 percent	7414	The Cagwin component makes up 50 percent of the map unit. Slopes are 50 to 70 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium over grus derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60

Soil Type	MUSYM	Description
	Code	
slopes, extremely stony		inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE021CA Pinus Jeffreyi/purshia Tridentata-Arctostaphylos Patula ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
Cassenai gravelly loamy coarse sand, 5 to 15 percent slopes, very stony	7421	The Cassenai, gravelly loamy coarse sand component makes up 78 percent of the map unit. Slopes are 5 to 15 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE023CA Pinus Jeffreyi/arctostaphylos Patula-Ceanothus Cordulatus/elymus Elymoides ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
Cassenai gravelly loamy coarse sand, 15 to 30 percent slopes, very stony	7422	The Cassenai, gravelly loamy coarse sand component makes up 73 percent of the map unit. Slopes are 15 to 30 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE023CA Pinus Jeffreyi/arctostaphylos Patula-Ceanothus Cordulatus/elymus Elymoides ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Cassenai gravelly loamy coarse sand, 30 to 50 percent slopes, very stony	7423	The Cassenai, gravelly loamy coarse sand component makes up 78 percent of the map unit. Slopes are 30 to 50 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE023CA Pinus Jeffreyi/arctostaphylos Patula-Ceanothus Cordulatus/elymus Elymoides ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Soil Type	MUSYM Code	Description
Cassenai gravelly loamy coarse sand, 50 to 70 percent slopes, very stony	7424	The Cassenai, gravelly loamy coarse sand component makes up 78 percent of the map unit. Slopes are 50 to 70 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE023CA Pinus Jeffreyi/arctostaphylos Patula-Ceanothus Cordulatus/elymus Elymoides ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
Cassenai cobbly loamy coarse sand, moist, 15 to 30 percent slopes, very bouldery	7426	The Cassenai, moist component makes up 80 percent of the map unit. Slopes are 15 to 30 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrinkswell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Cassenai cobbly loamy coarse sand, moist, 30 to 50 percent slopes, very bouldery	7427	The Cassenai, moist component makes up 80 percent of the map unit. Slopes are 30 to 50 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrinkswell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Christopher-Gefo complex, 0 to 5 percent slopes	7444	The Christopher, Loamy coarse sand component makes up 45 percent of the map unit. Slopes are 0 to 5 percent. This component is on hillslopes on outwash terraces, mountains. The parent material consists of outwash derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in

Soil Type	MUSYM	Description
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		the F022AE006CA Pinus Jeffreyi-Abies Concolor/ceanothus Cordulatus-Ceanothus Prostratus/pedicularis Semibarbata-Kelloggia Galioides ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
		The Gefo, gravelly loamy coarse sand component makes up 35 percent of the map unit. Slopes are 0 to 5 percent. This component is on hillslopes on outwash terraces, mountains. The parent material consists of outwash derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the F022AE006CA Pinus Jeffreyi-Abies Concolor/ceanothus Cordulatus-Ceanothus Prostratus/pedicularis Semibarbata-Kelloggia Galioides ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
Gefo gravelly loamy coarse sand, 2 to 9 percent slopes	7451	The Gefo, gravelly loamy coarse sand component makes up 80 percent of the map unit. Slopes are 2 to 9 percent. This component is on hillslopes on outwash terraces, mountains. The parent material consists of outwash derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the F022AE006CA Pinus Jeffreyi-Abies Concolor/ceanothus Cordulatus-Ceanothus Prostratus/pedicularis Semibarbata-Kelloggia Galioides ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
Gefo gravelly loamy coarse sand, 9 to 30 percent slopes	7452	The Gefo, gravelly loamy coarse sand component makes up 80 percent of the map unit. Slopes are 9 to 30 percent. This component is on hillslopes on outwash terraces, mountains. The parent material consists of outwash derived from granodiorite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 3 percent. This component is in the F022AE006CA Pinus Jeffreyi-Abies Concolor/ceanothus Cordulatus-Ceanothus Prostratus/pedicularis Semibarbata-Kelloggia Galioides ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Soil Type	MUSYM Code	Description
Meeks gravelly loamy coarse sand, 15 to 30 percent slopes, extremenly bouldery	7485	The Meeks, extremely bouldery component makes up 80 percent of the map unit. Slopes are 15 to 30 percent. This component is on moraines, mountains. The parent material consists of till derived from granodiorite. Depth to a root restrictive layer, duripan, is 41 to 73 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrinkswell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE013CA Abies Concolor-Pinus Lambertiana/quercus Vacciniifolia-Amelanchier Utahensis/pyrola Picta ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Meeks gravelly loamy coarse sand, 30 to 70 percent slopes, extremely bouldery	7486	The Meeks, extremely bouldery component makes up 80 percent of the map unit. Slopes are 30 to 70 percent. This component is on moraines, mountains. The parent material consists of till derived from granodiorite. Depth to a root restrictive layer, duripan, is 41 to 73 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is very low. Shrinkswell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE013CA Abies Concolor-Pinus Lambertiana/quercus Vacciniifolia-Amelanchier Utahensis/pyrola Picta ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Oneidas coarse sandy loam, 0 to 5 percent slopes	7491	The Oneidas component makes up 80 percent of the map unit. Slopes are 0 to 5 percent. This component is on hillslopes on outwash terraces, mountains. The parent material consists of outwash and/or till derived from granodiorite. Depth to a root restrictive layer, fragipan, is 10 to 20 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during March, April, May, June. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE009CA Pinus Contorta Var. Murrayana/ceanothus Cordulatus/elymus Elymoides ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Toem-Rock outcrop complex, 50 to 70 percent slopes	7533	The Toem component makes up 45 percent of the map unit. Slopes are 50 to 70 percent. This component is on hillslopes, mountain slopes, mountains. The parent material consists of colluvium and/or residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in

Soil Type	MUSYM	Description
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		the R022AE210CA Shallow Sandy Slope ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
Oxyaquic Cryorthents-Aquic Xerorthents-Tahoe complex, 0 to 15 percent slopes	9011	The Oxyaquic Cryorthents component makes up 30 percent of the map unit. Slopes are 0 to 15 percent. This component is on drainageways, mountains. The parent material consists of alluvium and/or colluvium derived from mixed. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 29 inches during March, April, May. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE004CA Populus Tremuloides-Abies Concolor/elymus Glaucus ecological site. Nonirrigated land capability classification is 6w. This soil does not meet hydric criteria.
		The Aquic Xerorthents component makes up 28 percent of the map unit. Slopes are 0 to 15 percent. This component is on drainageways, mountains. The parent material consists of alluvium and/or colluvium derived from mixed. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 29 inches during March, April, May. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE004CA Populus Tremuloides-Abies Concolor/elymus Glaucus ecological site. Nonirrigated land capability classification is 6w. This soil does not meet hydric criteria.
		The Tahoe, gravelly component makes up 15 percent of the map unit. Slopes are 0 to 5 percent. This component is on flood plains, valley flats, mountains. The parent material consists of alluvium derived from granitic and volcanic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is occasionally flooded. It is occasionally ponded. A seasonal zone of water saturation is at 6 inches during March, April, May. Organic matter content in the surface horizon is about 18 percent. This component is in the R022AE214CA Gravelly Flats ecological site. Nonirrigated land capability classification is 6w. This soil meets hydric criteria.
Sky gravelly sandy loam, 9 to 30 percent slopes	9161	The Sky component makes up 80 percent of the map unit. Slopes are 9 to 30 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum from andesitic tuff. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic

Soil Type	MUSYM	Description
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		matter content in the surface horizon is about 80 percent. This component is in the F022AE019CA Tsuga Mertensiana-Abies Magnifica/eucephalus Breweri ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Sky gravelly sandy loam, 30 to 50 percent slopes	9162	The Sky component makes up 80 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum from andesitic tuff. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE019CA Tsuga Mertensiana-Abies Magnifica/eucephalus Breweri ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Mountrose- Wardcreek-Melody complex, 50 to 70 percent slopes	9171	The Mountrose component makes up 35 percent of the map unit. Slopes are 30 to 70 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium derived from volcanic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 8 percent. This component is in the R022AE215CA Deep Cryic Volcanic Slope ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
		The Wardcreek component makes up 25 percent of the map unit. Slopes are 30 to 70 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from andesite. Depth to a root restrictive layer, bedrock (lithic), is 20 to 39 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. This component is in the R022AE219CA Cryic Volcanic Slope ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
		The Melody component makes up 20 percent of the map unit. Slopes are 30 to 70 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium derived from volcanic rock. Depth to a root restrictive layer, bedrock (lithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrinkswell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of

Soil Type	MUSYM	Description	
	Code		
		72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the R022AE219CA Cryic Volcanic Slope ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.	
Dagget very gravelly loamy coarse sand, 30 to 50 percent slopes, extremely bouldery	9402	The Dagget, very gravelly loamy coarse sand component makes up 75 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite over grus. Depth to a root restrictive layer, bedrock (paralithic), is 39 to 59 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.	
Dagget very gravelly loamy coarse sand, 50 to 70 percent slopes, extremely bouldery	9403	The Dagget, very gravelly loamy coarse sand component makes up 75 percent of the map unit. Slopes are 50 to 70 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium derived from granodiorite over grus. Depth to a root restrictive layer, bedrock (paralithic), is 39 to 59 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.	
Jobsis-Whittell- Rock outcrop complex, cool, 8 to 30 percent slopes	9421	The Jobsis component makes up 45 percent of the map unit. Slopes are 8 to 30 percent. This component is on mountains, mountains. The parent material consists of colluvium derived from granodiorite over residuum derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the F022AY134NV Pinus Albicaulis/carex-Poa ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.	
		The Whittell component makes up 25 percent of the map unit. Slopes are 8 to 30 percent. This component is on mountains, mountains. The parent material consists of colluvium derived from granodiorite over residuum derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class	

Soil Type	MUSYM	Description
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		is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE001CA Pinus Albicaulis/arabis Platysperma ecological site. Nonirrigated land capability classification is 7e.
Temo-Witefels complex, 5 to 15 percent slopes	9441	The Temo component makes up 45 percent of the map unit. Slopes are 5 to 15 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F022AY121NV Pinus Contorta-Abies Magnifica/artemisia Tridentata Ssp. Tridentata/achnatherum Occidentale Ssp. Occidentale-Carex Rossii ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
		The Witefels component makes up 35 percent of the map unit. Slopes are 5 to 15 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium and/or residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.
Temo-Witefels complex, 15 to 30 percent slopes	9442	The Temo component makes up 45 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F022AY121NV Pinus Contorta-Abies Magnifica/artemisia Tridentata Ssp. Tridentata/achnatherum Occidentale Ssp. Occidentale-Carex Rossii ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.

Soil Type	MUSYM	Description
	Code	
		The Witefels component makes up 35 percent of the map unit. Slopes are 15 to 30 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium and/or residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.
Temo-Witefels complex, 30 to 50 percent slopes	9443	The Temo component makes up 45 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F022AY121NV Pinus Contorta-Abies Magnifica/artemisia Tridentata Ssp. Tridentata/achnatherum Occidentale Ssp. Occidentale-Carex Rossii ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
		The Witefels component makes up 35 percent of the map unit. Slopes are 30 to 50 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium and/or residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.
Temo-Witefels complex, 50 to 70 percent slopes	9444	The Temo component makes up 45 percent of the map unit. Slopes are 50 to 70 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium over residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 5 percent. This component is in the F022AY121NV Pinus Contorta-Abies Magnifica/artemisia Tridentata Ssp. Tridentata/achnatherum Occidentale Ssp.

Soil Type	MUSYM	Description
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		Occidentale-Carex Rossii ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
		The Witefels component makes up 35 percent of the map unit. Slopes are 50 to 70 percent. This component is on mountain slopes, mountains. The parent material consists of colluvium and/or residuum weathered from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE010CA Abies Magnifica-Pinus Monticola/arctostaphylos Nevadensis ecological site. Nonirrigated land capability classification is 8. This soil does not meet hydric criteria.
Whittell-Jobsis- Rock outcrop complex, cool, 30 to 75 percent slopes	9461	The Whittell component makes up 45 percent of the map unit. Slopes are 30 to 75 percent. This component is on mountains, mountains. The parent material consists of colluvium derived from granodiorite over residuum derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 20 to 39 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 80 percent. This component is in the F022AE001CA Pinus Albicaulis/arabis Platysperma ecological site. Nonirrigated land capability classification is 7e.
		The Jobsis component makes up 25 percent of the map unit. Slopes are 30 to 75 percent. This component is on mountains, mountains. The parent material consists of colluvium derived from granodiorite over residuum derived from granodiorite. Depth to a root restrictive layer, bedrock (paralithic), is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. This component is in the F022AY134NV Pinus Albicaulis/carex-Poa ecological site. Nonirrigated land capability classification is 7s. This soil does not meet hydric criteria.

Appendix C – Vegetation List

Table 6. List of common plants found within Lake Tahoe Nevada State Park.

TREES

Common Name	Scientific Name
White fir	Abies concolor
Red fir	Abies magnifica
Incense cedar	Calocedrus decurrens
Western juniper	Juniperus occidentalis
Whitebark pine	Pinus albicaulis
Foxtail pine	Pinus balfouriana
Lodgepole Pine	Pinus contorta var. murrayana
Limber pine	Pinus flexilis
Jeffrey Pine	Pinus jeffreyi
Sugar pine	Pinus lambertiana
Singleleaf pinyon pine	Pinus monophylla
Western white pine	Pinus monticola
Ponderosa Pine	Pinus ponderosa
Quaking aspen	Populus tremuloides
Black cottonwood	Populus trichocarpa
Willow species	Salix spp
Mountain ash	Sorbus californica
Mountain hemlock	Tsuga mertensiana

SHRUBS

Common Name	Scientific Name
Alder	Alnus tenuifolia
Pale Serviceberry or Shadberry	Amelanchier pallida
Pinemat manzanita	Arctostaphylos nevadensis
Greenleaf manzanita	Arctostaphylos patula
Big sagebrush	Artemisia tridentata
Sierra chinquapin	Castanopsis sempervirens
Mountain whitethorn, buckbrush	Ceanothus cordulatus
Mahala mat (formerly Squaw carpet)	Ceanothus prostratus
Tobacco brush, snowbrush	Ceanothus velutinus
Curl leaf mountain mahogany	Cercocarpus ledifolius
Rabbitbrush	Chrysothamnus naseosus
Red-osier dogwood	Cornus stolonifera
Honeysuckle	Lonicera involucrata

Common Name	Scientific Name
Bitter cherry	Prunus emarginata
Bitterbrush	Purshia tridentata
Huckleberry oak	Quercus vaccinifolia
Golden currant	Ribes aureum
Wax currant	Ribes cereum
Gosseberry	Ribes montigenum
Wood's rose	Rosa woodsi
Elderberry	Sambucus microbotyrs
Creeping snowberry	Symphoricarpos mollis

HERBACEOUS/FLOWERING

Scientific Name				
Achillea lanulosa				
Aconitum columbianum				
Agastache urticifolia				
Allium bisceptrum				
Allium validum				
Alopecuris aequalis				
Antonnaria rosea				
Apocynum pumilum				
Aquilegia formosa				
Arabis rigidissima var. demota				
Arabis spp				
Arnica cordifolia				
Arnica mollis				
Aster integrifolius				
Balsamorhiza sagittata				
Barbarea orthoceras				
Calochortus nudus				
Caltha biflora				
Calyptridium umbellatum				
Cardamine breweri				
Castillegia densiflora				
Castilleja applegatei				
Castilleja spp				
Cerastium vulgatum				
Chrysanthemum leucanthemum				
Chrysopsis breweri				
Circaea □ggreg pacifica				
Cirsium andersonii				

C-2

Common Name	Scientific Name				
Farewell to Spring	Clarkia spp				
Small-flowered Blue-eyed Mary	Collinsia parviflora				
Torrey's Blue-eyed Mary	Collinsia torreyi				
Blue eyed Mary	Collinsia verna				
Grand Collomia	Collomia grandiflora				
Brittle-fern	Cystopteris fragilis				
Larkspur (Tower Delphinium)	Delphinium glaucum				
Tansy Mustard	Descurainea incana				
Mountain Tansy-mustard	Descurainia richardsonii				
Alpine Shooting Star	Dodecatheon alpinum				
Cup Lake draba	Draba asterophora var. macrocarpa				
Tahoe draba	Draba asterophora var. sterophora				
Alaska Whitlow-grass	Draba stenoloba ramosa				
Fireweed	Epilobium angustifolium				
Horsetail	Equisetum arvense				
Butterweed, flea bane	Erigeron canadense				
Nodding Eriogonum	Eriogonum cernuum				
Buckwheat spp	Eriogonum spp				
Buckwheat sulfur flower	Eriogonum umbellatum				
Torrey's buckwheat	Eriogonum umbellatum var. torryanum				
Sierra Wallflower	Erysimum capitatum ssp. perenne				
Sierra Wallflower	Erysimum perenne				
Wild strawberry	Fragaria virginiana				
Trifid Bedstraw	Galium trifidum subbiflorum				
Fragrant or Sweet-scented Bedstraw	Galium triflorum				
Diffuse Gayophytum	Gayophytum diffusum parviflroum				
One-flowered or Hikers Gentian	Gentiana simplex				
Sierra Rein Orchid	Habenaria dilatata var. leucostachys				
Stickseed	Hackelia micrantha				
Cow-Parsnip, Cow-Cabbage	Heracleum lanatum				
Dusky Horkelia	Horkelia fusca				
Woolen-breeches, Dwarf Waterleaf	Hydrophyllum capitatum				
Creeping St. John's-wort or Tinker's Penny	Hypericum anagalloides				
Scarlet Gilia, Skyrocket Gilia, Foxfire (also known as Gilia aggregate)	Ipomopsis aggregata				
Iris	Iris hartwegii				
Nevada Pea	Lathyrus lanszwertii				
Wild Pepper-grass	Lepidium virginicum				
Dwarf Lewisia	Lewisia pygmaea				
Long-petaled lewisia	Lewisia pygmaea spp. Longipetala				

Common Name	Scientific Name
Gray's Lovage	Ligusticum grayi
Alpine Lily, Small Leopard or Tiger Lily	Lilium parvum
Mustang Linanthus	Linanthus montanus
Rock Star	Lithophragma bulbifera
Woodland Star	Lithophragma glabrum
Sierra Nevada Lotus	Lotus nevadensis
Spurred Lupine	Lupinus arbustus
Brewers Lupine	Lupinus brewerii
Washington Lupine, Tahoe Lupine	Lupinus polyphyllus
Stickleaf	Mentzelia spp
Nodding Scorzonella	Microseris nutans
Slender Phlox	Microsteris gracilis
Dwarf Monkey Flower	Mimulus nanus
Mountain Monkey Flower	Mimulus primuloides
Meadow or Primrose Monkey-flower	Mimulus primuloides pilosellus
Mountain Pennyroyal	Monardella odoaratissima
Miners Lettuce	Montia perfoliata
Evening Primrose	Oenothera biennis
Northern Sun-cup (also known as Camissonia subacaulis)	Oenthera subacaulis
Mountain Sweet-cicely	Osmorhiza chilensis
Sweet Cicily	Osmorhiza occidentalis
Western or Brown's Peony	Paeonia brownii
Dwarf Lousewort	Pedicularis centranthera
Meadow Penstemon	Penstemon rydbergii
Penstemon spp	Penstemon spp
Alpine Phacelia	Phacelia hastata
Low Phacelia	Phacelia humilis
Spreading Phlox	Phlox diffusa
Jacon's Ladder	Polemonium caeruleum amygdalinum
American Bistort, Knotweed, Snakeweed	Polygonum bistortoides
Sawatch or Douglas' Knotweed	Polygonum douglasii johnstonii
Fanleaf Cinquefoil	Potentilla flabellifolia
Bush Cinquefoil	Potentilla fruiticosa
Sticky Cinquefoil	Potentilla glandulosa
Cinquefoil spp	Potentilla spp
Bracken fern	Pteridium aquillinum var. pubescens
Pinedrops	Pterospora andromedea
Bog Wintergreen	Pyrola asarifolia
Raillardella (green leaved)	Raillardella scaposa

Common Name	Scientific Name
Plantainleaf Buttercup	Ranunculus alismaefolius
Desert Buttercup or Crowfoot	Ranunculus cymbalaria saximontanus
Western Buttercup	Ranunculus occidentalis ultramontanus
Wax or Squaw Currant	Ribes cereum
Tahoe yellow cress	Rorippa subumbellata
Sheep Sorrel	Rumex acetosella
Sierra Sanicle	Sanicula gravolens
Snow Plant	Sarcodes sanguinea
Single-stemmed Butterweed or Groundsel	Senecio integerrimus major
Arrowhead Butterweed, Arrowleaf Groundsel	Senecio triagularis
Checker mallow	Sidalcea glaucescens
Hidden-petaled campion	Silene invisia
False Solomon Seal	Smilacina stullata
Goldenrod	Solidago canadensis
Swamp White-heads, Rangers Buttons	Sphenosciadium capitellatum
Long stalk starwort	Stellaria longipes var. longipes
Common Dandelion	Taraxacum officinale
Fendler's Meadow-Rue	Thalictrum fendleri
Carpet Clover	Trifolium monanthum
White Clover	Trifolium repens
Stinging nettles	Urtica serra
California Valerian	Valeriana capitata californica
Corn-lily, False-hellebore (sometimes erroneously called Skunk-cabbage)	Veratrum californicum
Woolly Mullein	Verbascum thapsus
Thyme-leaved Speedwell	Veronica serpyllifolia humifusa
Mountain Violet	Viola purpurea
Wooly Mulesears	Wyethia mollis

GRASSES

Common Name	Scientific Name
Idaho bentgrass	Agorostis idahoensis
Slender wheatgrass	Agropyron trachycaulum
Fringed brome	Bromus ciliatus
Mountain brome	Bromus marginatus
Cheatgrass	Bromus tectorum
Bluejoint reeedgrass	Calamagrostis
Water sedge	Carex aquatilis
SInderbeak sedge	Carex athrostachya
Douglas sedge	Carex douglasii
Jepson sedge	Carex jepsonii
Jones sedge	Carex jonesii
Woolly sedge	Carex lanuginose
Nebraska sedge	Carex nebrascensis
Sierra sedge	Carex paucifructus
Ross sedge	Carex rossii
Beaked sedge	Carex rostrata
Sedge spp	Carex spp
Drooping woodreed	Cinna latifolia
Annual hairgrass	Deschampsia danthonioides
SInder hairgrass	Deschampsia elongate
Spikesedge	Eleocharis acicularis
Blue wildry	Elymus glaucus
Red fescue	Festuca rubra
Tall mannagrass	Glyceria elata
Spike mannagrass	Glyceria erecta
Meadow barley	Hordeum brachyantherum
Baltic rush	Juncus balticus
Rush spp	Juncus spp

Table 7. Definitions for Late Successional/Old Growth Forest (adapted from Beardsley, et al. (1999), Table 13 - Key structural characteristics of the definitions of old growth in termberland forest types, Sierra Nevada).

Forest Type	Site Class*	Minimum Stand Age	<u>Live</u>	<u>Live Trees</u> <u>Snags</u>		<u>Logs</u>			
		Years	Diameter (Inches)	Minimum# per acre	Diameter (Inches)	Minimum# per acre	Diameter (Inches)	Length (Feet)	Minimum# per acre
White Fir	High (1a-1)	143	39	7			10 & 20	10	6.1 & 5.2
	Med (2-3)	188	39	6			10 & 20	10	6.1 & 5.2
	Low (4-5)	239	29	6			10 & 20	10	6.1 & 5.2
Interior Ponderosa	High (1a-3)	150	21 and 30	30 and 3					
Pine	Low (4-5)	200	21	13					
Jeffrey Pine	High (1a-3)	150	30	4.3					
1 1110	Low (4-5)	200	30	2.2					
Lodgepole Pine	High (1a-3)	150	25	10					
Fille	Low (4-5)	200	25	3					
Mixed Conifer	High (1a-1)	188	39	8					
20111101	Med (2-3)	253	39	6					
	Low (4-5)	256	29	5					

Forest Type	Site Class*	Minimum Stand Age	Live Trees		<u>Snags</u>		<u>Logs</u>		
		Years	Diameter (Inches)	Minimum# per acre	Diameter (Inches)	Minimum# per acre	Diameter (Inches)	Length (Feet)	Minimum# per acre
Mixed Subalpine									
Western White	High (1a-3)	15	30	5					
Pine	Low (4-5)	200	30	7					
Mountain Hemlock	High (1a-3)	15	30	8					
Пенноск	Low (4-5)	200	30	7	30	0.1			
White fir/Jeffrey	High (1a-3)	15	30	7	30	0.1			
Pine	Low (4-5)	200	30	3	30	0.3			

^{*} Site classes in paraenthese are used by the Pacific Southwest region of the Forest Service and are based on Dunnings site index curves for height in feet at 300 years. Roughly, class $1a \ge 182$, class 1 = 157 to 181, class 2 = 132 to 156, class 3 = 108 to 131, class 4 = 84 to 107, and class $5 \le 84$.

OBJECTIVES FOR REVEGETATION PROJECTS WITHIN NV TAHOE STATE PARKS.

Jenny Scanland Water Quality and Streams Program Manager Nevada Tahoe Resource Team, Division of State Lands May, 2005

MANAGEMENT STRATEGY

According to Tahoe Regional Planning Agency (TRPA) Code, the lands within the Spooner management unit of Lake Tahoe Nevada State Park are considered to be Land Conservation Areas. Land Conservation areas are areas with value as primitive or natural areas, with strong environmental limitations on use, and with a potential for dispersed recreation or low intensity resource management. These areas include stream environment zones, and other fragile areas, with out substantial existing improvements. Due to project location within a State Park, restoration, mitigation and remedial activities should be in sync with the natural appearing landscape and it's ecological context. In all cases, the use of native, local plant species (on site if possible) will be utilized to the fullest extent possible. Bioengineering, using natural materials, will be emphasized over that of hard, synthetic material and structures to ensure we are aiding in the success of naturally sustainable restoration. All erosion control, revegetation and SEZ enhancement or restoration within the Park will follow four general approaches in the following order when feasible:

- **I.** "Undisturbed self-recovery": where the stream ecosystem is recovering rapidly, and a forced design is unnecessary and may even be detrimental.
- **II. "Assisted recovery":** where a stream ecosystem is attempting to recover, but doing so slowly or uncertainly. In such a case, design may facilitate natural processes already occurring.
- **III.** "Restoration": where the stream ecosystem must be completely recreated or rebuild to achieve function of natural processes and alleviate severe erosion problems.
- **IV.** "Engineered": when an impact from either natural causes or man-induced, permanent recreation or transportation facilities renders a system "irreplaceable". Or when those impacts can only be mitigated with engineered hard structures in order to successfully protect that system.

OBJECTIVES

- 1. Plan preparation should include a qualified revegetation/erosion control specialist or team.
 - Plans and specifications for revegetation projects should contain a complete erosion control package that reflects the objectives in this document.

- Revegetation/erosion control specialist should be included in the planning process from plan inception to ensure that the engineering and biological components of the projects are completely integrated, i.e.:
 - Acquisition of native plant materials takes at least one years advance planning.
 - In some instances, the engineering components of the project will support the vegetative component.
 - Bioengineering should be utilized where feasible in all projects within the State Park
- The revegetation/erosion control specialist or team member should function as the revegetation inspector during project implementation.
- The project success criteria should be clearly defined.
 - At project completion: Plant replacement contingency should be included in case significant portions of the planted seedlings die or are very unhealthy.
 - 3-5 years following project completion (see #5 Maintenance/monitoring/adaptive management)

2. The site-specific soil parameters and existing plant community must be considered in revegetation/erosion control plan.

- Soil Preparation: Soil must be prepared so that the soil profile is free from compaction to approximately 12 inches wherever possible.
- Application of soil amendments: soil amendments should be applied evenly over the soil surface and then incorporated into the top 0.5 to 2 inch layer, unless otherwise specified by the supplier. This can also be done by mechanical rake or hand methods (usually a hand rake).
- Minimize future disturbance wherever possible.
- In areas that have had high levels of recreational traffic, such as hikers, joggers or mountain bikers, a well defined trail can be created that will concentrate traffic. In that concentrated traffic area, appropriate BMPs can be implemented that can reduce erosion.

3. Plant Materials: Native plant material should be used whenever possible.

- All areas in which soil is disturbed during operations will be planted with native seed and shrubs according to the revegetation specifications outlined here or in a site-specific revegetation/erosion control plan.
- Native plant material should be used whenever possible. The plant list should be designed so that the *target* plant community reflects an appropriate local native plant community.

Plant Species Identified in 2000 as occurring in Spooner management unit Forest Ecosystem:

	ant Species Identified in 2000 as occurring	in specific management unit i crest Lees	y Stelli.
F	COMMON NAME	SPECIES	ORIGIN
О			
R M			
F	LUPINE	L. GRAYI, L. BREWERI	N
F	VETCH	VICIA SPP	N
F	ARROWLEAF BALSAMROOT	BALSAMORHIZA SAGITATA	N
F	GROUDSEL	SENECIO SPP	N
F	HAWKSBEARD	CREPIS SPP	N
F	INDIAN PAIN BRUSH	CASTELLEJA SPP	N
F	LUPINE BROAD LEAVED	LUPINUS LATIFOLIUS	N
F	MT. PRIDE PENSTEMON	PENSTEMON NEWBERRYI	N
F	MULE EARS	WYETHIA MOLLIS	N
F	PENSTEMON	PENSTEMON SPP	N
F	FENDLERS MEADOWRUE	THALICTRUM FENDLERI	N
F	PUSSY TOES	ANTENNARIA SPP	N
F	YARROW	ACHILLIA MILLIFOLIA	N
F	YARROW	ACHILLIA LANULOSA	N
G	BOTTLE BRUSH SQUIRREL TAIL	SITANION HISTRIX	N
G	LEWIS FLAX	LINUM LEWISII	N
G	NEEDLE GRASS WESTERN	STIPA OCCIDENTALIS	N
G	ORCHARD GRASS PAIUTE	DACTYLIS GLOMERATA	IN
G	SHEEP FESCUE	FESTUCA OVINA	N
G	SHERMAN BIG BLUEGRASS	POA AMPLA	N
G	WHEATGRASS LUNA PUBSESCENT	AGROPYRON TRICOPHORUM	IN
G	WHEATGRASS SLENDER	AGROPYRON TRACHYCAULLUM	N
G	THICKSPIKE WHEATGRASS	AGROPYRON DASYSTACHYUM	N
S	CREEPING SNOWBERRY	SYMPHOROCARPOS ACUTUS	N
S	BITTERBRUSH	PURSHIA TRIDENTATA	N
S	ELDERBERRY	SAMBUCUS MICROBOTRYS	N
S	GOLDEN CURRENT	RIBES AUREUM	N
S	GREENLEAF MANZANITA	ARCTOSTAPHYLOS PATULA	N
S	HUCKLEBERRY OAK	QUERCUS VACCINIFOLIA	N
S	MT. WHITETHORN	CEANOTHUS CORDULATUS	N
S	SIERRA CURRENT	RIBES NEVADENSE	N
S	SNOWBRUSH/TABACCOBRUSH	CEANOTHUS VELUTINUS	N
S	WAX CURRANT	RIBES CEREUM	N
S	WILD ROSE	ROSA WOODSII	N
S	SIERRA CHINQUAPIN	CASTANOPSIS SEMPERVIRENS	N
S	SIERRA GOOSEBERRY	RIBES ROEZLII	N
S	SNOWBERRY	SYMPHORICARPOS ALBA	N
T	ALDER	ALNUS TENUIFOLIA	N
T	SUGAR PINE	PINUS LAMBERTIANA	N

T	BLACK COTTONWOOD	POPULUS TRICHOCARPA	N
T	JEFFERY PINE	PINUS JEFFERII	N
	RIPARIAN SPECIES		
G	BEAKED SEDGE	CAREX ROSTRATA	N
G	NEBRASKA SEDGE	CAREX NEBRASKENSIS	N
G	TUFTED HAIRGRASS	DESCHAMPSIA CAESPITOSA	N
G	WIRE GRASS JUNCUS	JUNCUS BALTICUS SPP	N
F	BIGLEAF LUPINE OR (PALMERS)	LUPINUS POLYPHYLLUS	N
F	BUTTERCUP	RANANCULUS SPP	N
F	CA FALSE HELLEBORE	VERATRUM CALIFORNICUM	N
F	THIMBLEBERRY	RUBUS PARVIFOIUS	N
F	DANDELION	TARAXICUM OFFICIANALE	IN
T	ASPEN	POPULUS TREMULOIDES	N
T	WILLOW SP.	SALIX PACIFICA?	N

Origin: N= Native IN=Introduced (not desirable)

- A combination of seedlings and direct seeding should be used to provide the best combination of protection.
- Seed or cuttings should be taken at the appropriate time and should be collected from as close to the project site as possible. Plant material that is to be used for seedlings/live plants may need to be collected well in advance of project construction, sometimes as much as a year in advance.
- Non-local, commercially available native grass species may be appropriate as a foundation for the seed mix. Seed or plant material collection should be supervised by a person knowledgeable about local native plant material collection.
 - Environmental, ecological and physiological requirements of seed should be considered when preparing a seed planting specification. Typically, seeds may be raked into the soil surface to a depth of no more that 0.5 inches in order to keep seed material from moving off site.
- Plants should be planted at the appropriate time of year, specified in the planting plan. A contingency should be provided if the target-planting window is not achieved. In the Spooner management unit, seeding may be conducted during operations in the late summer, fall and winter. Planting of shrubs and trees must occur early spring or fall.
 - Seedlings should be planted using an appropriate technique and a high-quality slow-release nutrient source.

4. A long lasting mulch material should be used.

• A native mulch such as pine needles or fir needles is preferred: 1 inch thick, consisting of pine needles collected on site, should be used as mulch over seeded and planted areas. Mulch material should be of a thickness that can both protect the soil surface and allow plant growth. Ground should be at least 95% covered with mulch.

- Hay and straw may NOT be used to decrease introduction of exotic and noxious weeds. Certified weed free or native straw should be used for short-term stabilization only.
- Wood chips from fuels reduction projects in the Park may be used for temporary erosion control, but not as mulch over plantings
- Seeded and planted areas should have Brush, logs, and other natural materials placed strategically across the project to make "people traffic" difficult or impossible. These materials must also be placed to appear natural.
- Geotextile materials can be used as a covering over a native mulch material, but should not be used as the primary mulch cover. They should consist of biodegradable materials and should include no plastics or other so-called 'photo-degradable' materials.
- An organic tackifier may be used on steeper slopes or in windy conditions or other situations where additional mulch stabilization is required.

5. Maintenance/Monitoring/Adaptive Management (Responsibility of Project Proponent)

- Projects should be designed so that irrigation is not needed. However, if long-term drought threatens plant survival during the first two growing seasons, irrigation may be considered. However, irrigation should only be used to assist in plant establishment.
- Short term and long term monitoring should be designed to ascertain immediate and long-term conditions, short-term survival and long term growth needs of the vegetation community. Soil movement should also be monitored. This information should feed back to the maintenance/adaptive management component.

Appendix E – Insects and Diseases List

The tables below provides a list of common forest insect pests and diseases present in the forests within the park.

Table 8. Insects

Mountain Pine Beetle Dendroctonus ponderosae

Fir Engrave Beetle Scolytus ventralis

Jeffrey Pine Beetle Dendroctonus jeffreyi

Western Pine Beetle Dendroctonus brevicomis

Red Turpentine Beetle Dendroctonus valens

Table 9. Diseases

Dwarf mistletoe Arceuthobium spp.

Ponderosa Pine Twig Scale

Matsucocus bisetosus

Annosus root disease

Heterobasidion annosum

Western gall rust Endocronartium harknessii

White pine blister rust Cronartium ribicola

Sooty-bark canker (aspen) Encoelia pruinosa

Cryptosphaeria canker (aspen) Cryptosphaeria populina

Black canker (aspen) Ceratocystis fimbriata

Cytospora canker (aspen) Cytospora chrysosperma

Hypoxylon canker (aspen) Hypoxylon mammatum

Ink Spot of Aspen Ciborinia spp.

Elytraderma Needle Cast Elytroderma deformans

Armillaria Root Disease *Armillaria spp.*

Black Stain Root Disease Leptographium wageneri

Appendix F - Birds, Mammals, Fish, and Herptiles List

Common and Uncommon Species Occurring in Lake Tahoe Nevada State Park.

Amphibians

Long-toed salamander Ambystoma macrodactylum

Pacific treefrog *Hyla regilla*

Bullfrog Rana catesbeiana

Birds

American Robin Turdus migratorius

Band-tailed Pigeon Coumba fasciata
Black-backed Woodpecker Picoides arcticus

Blue Grouse

Brown Creeper

Brown-headed Cowbird

Calliope Hummingbird

Cassin's Finch

Dendragapus obscurus

Certhia □mericana

Molothrus ater

Stellula calliope

Carpodacus cassinii

Cassin's Vireo Vireo cassinii

Chipping Sparrow Spizella passerine

Clark's Nuteracker Nucifraga Columbiana

Clark's Nutcracker Nucifraga Columbiana

Common Nighthawk Chordeiles minor
Common Raven Corvus corax

Dark-eyed Junco *Junco hyemalis*

Dusky Flycatcher Empidonax oberholseri

Fox Sparrow Passerella iliaca
Golden-crowned Kinglet Regulus satrapa
Great-horned Owl Bubo virginianus
Hairy Woodpecker Picoides villosus

Hammond's Flycatcher Empidonax hammondii
Hermit Thrush Catharus guttatus

Hermit Warbler Dendroica occidentalis
House Wren Troglodytes aedon

Lazuli Bunting Passarina amoena

MacGillivray's WarblerOporonis tolmieiMountain ChickadeePoecile gambeliMountain QuailOreortyx pictusMourning DoveZenaida macroura

Mourning Dove Zenaida macroura Northern Flicker Colaptes auratus Northern Goshawk Accipiter gentilis Olive-sided Flycatcher Contopus cooperi Osprey Pandion haliaetus Pileated Woodpecker Dryocopus pileatus Pine Siskin Carduelis pinus Pygmy Nuthatch Sitta pygmaea Red Crossbill Loxia curvirostra Sitta Canadensis Red-breasted Nuthatch

Red-breasted Sapsucker Sphyrapicus rubber Red-tailed Hawk Buteo jamaicensis

Song Sparrow Melospiza melodia Steller's Jay Cyanocitta stelleri

Warbling Vireo Vireo gilvus

Western Meadowlark

Western Tanager

Western Wood-pewee

White-breasted Nuthatch

Sturnella neglecta

Piranga ludoviciana

Contopus sordidulus

Sitta carolinensis

White-crowned Sparrow Zonotrichia leucophrys
Williamson's Sapsucker Sphyrapicus thyroideus

Wilson's Warbler Wilsonia pusilla

Yellow Warbler Dendroica petechia Yellow-rumped Warbler Dendroica coronata

Fish

Tahoe sucker Catostomus tahoensis
Lake whitefish Coregonus clupeaformis

Piute sculpin Cottus beldingi

Lahontan cutthroat trout Oncorhynchus clarkia henshawi

Rainbow trout Oncorhynchus mykiss
Kokanee salmon Oncorhynchus nerka

Mountain whitefish Prosopium williamsoni
Speckled dace Rhinichthys egregius

German brown trout Salmo trutta

Brook trout Salveninus fontinalis
Mackinaw (Lake) Trout Salvelinus namaycush

Mammals

Deer mouse

Mountain beaver Aplodontia rufa
Coyote Canis Latrans

Beaver Castor Canadensis
Porcupine Erithrozon dorsatum

Mountain lion Felis concolor
Bobcat Felis rufus

Nortthern flying squirrel Glaucomys sabrinus

Sierra Nevada snowshoe hare Lepus americanus tahoensis

Yellow-bellied marmot Marmota flaviventris American pine marten Martes americana Mountain vole Microtus montanus Montane vole Microtus montanus Ermine Mustela erminea Mustela frenata Long-tailed weasel California myotis Myotis californicus Little brown myotis Myotis lucifugus Bushy-tailed woodrat Neotoma lepida American Mink Neovison vison Pica Ochotona princeps Mule Deer Odocoileus hemionus

Raccoon Procyon lotor
Western gray squirrel Sciurus griseus
Trowbridge's shrew Sorex trowbridgii
Vagrant shrew Sorex vagrans

California ground squirrel

Belding's ground squirrel

Golden-mantled ground squirrel

Western spotted skunk

Yellow pine chipmunk

Spermophilus beecheyi

Spermophilus beldingi

Spermophilus lateralis

Spilogale gracilis

Tamias amoenus

Peromyscus maniculatus

Lodgepole chipmunk Tamias speciosus

Douglas' Squirrel Tamiasciurus douglasii

Black Bear Ursus americanus

Reptiles

Western Fence Lizard Sceloporus occidentalis

Rubber boa Charina bottae

Western aquatic garter snake Thamnophis couchii

Western terrestrial garter snake Thamnophis elegans

Common garter snake Thamnophis sirtalis

Table 10. Point count tallies, 2006 Breeding Bird Survey.

Species Species	Tunnel Creek	North Canyon	Van Sickle
American Robin	10	15	
Band-tailed Pigeon	10	5	
Blue Grouse	1	0	
Brown-headed Cowbird	5	4	
Calliope Hummingbird	1	1	
Cassin's Finch	6	9	
Cassin's Vireo	0	3	
Chipping Sparrow	0	1	
Clark's Nutcracker	5	1	
Common Raven	6	21	
Dark-eyed Junco	15	0	
Golden-crowned Kinglet	0	1	
Hammond's Flycatcher	5	9	
Hermit Thrush	2	8	
Hermit Warbler	0	2	
House Wren	0	1	
Lazuli Bunting	0	2	
MacGillivray's Warbler	0	7	
Mourning Dove	4	0	
Mountain Chickadee	23	11	
Northern Flicker	1	4	
Northern Goshawk	1	0	
Olive-sided Flycatcher	1	3	
Red-breasted Sapsucker	0	2	
Solitary Vireo	4	0	
Song Sparrow	1	3	
Stellar's Jay	12	0	
Warbling Vireo	13	12	
Western Tanager	11	4	

Species	Tunnel Creek	North Canyon	Van Sickle
Western Wood Pewee	21	0	
Wilson's Warbler	1	6	
Yellow Warbler	10	22	
Red-breasted Nuthatch	9	15	

Table 11. Point count tallies, 2007 Breeding Bird Survey.

Species Species	Tunnel Creek	North Canyon	Van Sickle
American Robin	9	12	6
Audubon's Warbler	6	10	2
Band-tailed Pigeon	5	3	3
Black-headed Grosbeak	1	2	0
Blue Grouse	1	0	0
Brown Creeper	0	1	5
Brown-headed Cowbird	4	3	2
Calliope Hummingbird	0	0	1
Cassin's Finch	8	10	2
Cassin's Vireo	6	1	1
Chipping Sparrow	1	6	0
Clark's Nutcracker	3	3	10
Common Raven	3	5	1
Dark-eyed Junco	9	19	7
Downy Woodpecker	1	2	2
Dusky Flycatcher	5	4	1
Golden-crowned Kinglet	3	5	0
Hammond's Flycatcher	4	5	2
Hermit Thrush	4	7	2
Hermit Warbler	0	1	0
House Wren	0	2	0
Lazuli Bunting	0	3	0
MacGillivray's Warbler	5	3	0
Mourning Dove	6	0	0
Mountain Chickadee	12	27	13
Nashville Warbler	3	0	0
Northern Flicker	2	2	4
Northern Goshawk	0	0	0
Olive-sided Flycatcher	2	1	1

Species	Tunnel Creek	North Canyon	Van Sickle
Osprey	2	0	0
Pine Grosbeak	0	2	0
Pine Siskin	0	0	2
Pygmy Nuthatch	0	0	2
Red-breasted Nuthatch	8	13	5
Red-breasted Sapsucker	1	4	0
Red-tailed Hawk	0	1	1
Sharp-shinned Hawk	0	0	1
Solitary Vireo	1	0	0
Song Sparrow	2	3	0
Spotted Towhee	2	0	1
Stellar's Jay	21	17	21
Townsend's Solitaire	1	0	1
Tree Swallow	0	0	1
Unidentified Woodpecker	0	0	1
Warbling Vireo	17	11	3
Western Bluebird	0	0	2
Western Tanager	11	16	8
Western Wood Pewee	21	14	8
White-breasted Nuthatch	7	12	3
White-headed Woodpecker	1	2	3
William's Sapsucker	0	0	3
Wilson's Warbler	3	4	0
Yellow Warbler	1	4	1
Yellow-rumped Warbler	2	6	0
Yellow-throated Warbler	3	5	0

Table 12. Point count tallies, 2008 Breeding Bird Survey.

Species Species	Tunnel Creek	North Canyon	Van Sickle
American Robin	10	9	2
Black-backed Woodpecker	0	0	1
Blue Grouse	1	0	0
Brown Creeper	0	2	1
Brown-headed Cowbird	3	0	1
Calliope Hummingbird	1	0	1
Cassin's Finch	9	9	6
Cassin's Vireo	0	3	0
Clark's Nutcracker	3	0	3
Dark-eyed Junco	8	7	3
Dusky Flycatcher	9	5	3
Golden-crowned Kinglet	0	2	1
Green-tailed Towhee	3	1	2
Hermit Thrush	0	2	0
Hermit Warbler	0	1	0
House Wren	4	0	5
MacGillivray's Warbler	5	10	4
Mourning Dove	3	0	0
Mountain Chickadee	12	17	17
Northern Flicker	0	2	0
Olive-sided Flycatcher	12	7	14
Pine Siskin	0	1	0
Pygmy Nuthatch	1	0	3
Red-breasted Nuthatch	0	13	10
Red-breasted Sapsucker	19	2	1
Rock Pigeon	0	0	10
Song Sparrow	0	4	0
Stellar's Jay	23	7	10
Townsend's Solitaire	0	1	2

Species	Tunnel Creek	North Canyon	Van Sickle
Unidentified Woodpecker	0	1	2
Warbling Vireo	4	25	0
Western Tanager	12	18	4
Western Wood Pewee	15	10	3
White-breasted Nuthatch	1	2	4
White-headed Woodpecker	2	2	4
William's Sapsucker	0	1	3
Wilson's Warbler	1	1	0
Yellow-rumped Warbler	2	7	3

Appendix G – Nutrient Concentrations for Marlette and Spooner Lakes, 2002 - 2003

(Excerpted and modified from USGS Open File Report 2004-1333)

Number of samples and median and range of concentrations of nutrient species in Spooner and Marlette Lakes.

[Symbol: <, less than. For each site and constituent, the top number is the median value and the bottom numbers are the ranges of concentrations at that site; concentrations are expressed as micrograms per liter as N, P, or Fe]

Site name	Data type	Number of samples	Dissolved nitratea	Dissolved ammonia	Total Kjeldahl nitrogen	Dissolved orthophosp hate	Total phosphorus	Total bioreactive iron
Spooner Lake	All Data	16	5.0	5.6	^b 548	<1.0	18.5	^d 150
			<2.0-24.1	<3.0-14.7	120-892	<1.0-3.0	13.6-60.4	17.9-7,436
	Epilimnion	11	4.2	5.2	^f 465	<1.0	18.1	150
			<2.0-8.4	<3.0-14.7	120-816	<1.0-3.0	13.6-60.4	17.9-995.2
	Hypolimniom	5	6.2	5.8	618	<1.0	29.4	^g 873
			<2.0-24.1	<3.0-13.5	452-892	<1.0-1.2	17.2-39.5	48.2-7,436
Marlette Lake	All Data	17	5.0	8.1	^d 254	<1.0	10.8	56.4
			3.3-9.5	<3.0-28.8	87-376	<1.0-1.2	5.5-20.5	42.5-366.6
	Epilimnion	11	4.8	7.1	^h 200	<1.0	6.4	49.3
			3.3-7.3	<3.0-16.9	87-376	<1.0-1.0	5.5-14.3	42.5-299.2
	Hypolimniom	6	5.9	12.0	ⁱ 280	<1.0	14.6	145
			4.0-9.5	<3.0-28.8	243-373	<1.0-1.2	10.8-20.5	56.4-366.6

^aNitrate results include all oxidized forms of nitrogen (nitrate plus nitrite) as determined by the hydrazine method.

^bMedian values are those of a reduced number of samples: 14 samples.

^cMedian values are those of a reduced number of samples: 6 samples.

^dMedian values are those of a reduced number of samples: 15 samples.

^eMedian values are those of a reduced number of samples: 7 samples.

^fMedian values are those of a reduced number of samples: 9 samples.

^gMedian values are those of a reduced number of samples: 4 samples.

^hMedian values are those of a reduced number of samples: 10 samples.

ⁱMedian values are those of a reduced number of samples: 5 samples.

Median nutrient concentrations for samples collected from Lower and Upper Echo, Fallen Leaf, Spooner, and Marlette Lakes from previous studies and this study

[Abbreviations: e, epilimnion; h, hypolimnion; TRPA, Tahoe Research Planning Agency; USGS, U.S. Geological Survey; --, placeholder; <, less than. Reported nitrate concentrations are the sum of nitrate and nitrite]

Year(s) data collected:	1974–75	1991–92	1991–92	1994	1997–98	2002-03
Reference	Fuller (1975)	Sater (1994)	USGS	TRPA	USGS	This report
Spooner Lake						
Nitrate (μg/L as N)		3	3			5
Ammonia (μg/L as N)		6	11.5			5.6
Total Kjeldahl nitrogen(µg/L as N)		644	494			548
Orthophosphate(µg/L as P)		5	2.5			<1
Total Phosphorous (μg/L as P)		21	17			18.5
Bioactive iron (μg/L as Fe)		90	100			150
Marlette Lake						
Nitrate (μg/L as N)		4	64		3.8	5
Ammonia (µg/L as N)		16	52		11	8.1
Total Kjeldahl nitrogen(μg/L as N)		420	344		217	254
Orthophosphate(µg/L as P)		7	3.5		11	<1
Total Phosphorous (μg/L as P)		14	20		27	10.8
Bioactive iron (μg/L as Fe)		190	96		155	56.4

Appendix H – List of Significant Historic Resources

Resource	Type	Management Unit
Marlette Water System (MWS)	Historic	Marlette-Hobart Backcountry
Red House	Historic	
Tunnel Creek Station	Historic	
Rocky Point Chimney	Historic	
 Marlette Dam Maintenance Station 	Historic	
Hannah's Cabin	Historic	Marlette-Hobart Backcountry
Spencer's Cabin	Historic	Marlette-Hobart Backcountry
Woodcutter's Cabin	Historic	Marlette-Hobart Backcountry
Steamboiler	Historic	Marlette-Hobart Backcountry
Van Sickle Barn	Historic	Van Sickle Bi-State Park
Spooner Lake Milling Site	Pre-Historic	Spooner Lake

Appendix I – Additional Coarse Woody Debris Considerations for Specific Species

Coarse Woody Debris Values to Wildlife by Tree Species

This section provides information on habitat values provided by specific species of snags and logs, modified from Parks, et al. (1997), to further assist the land manager in snag and log selection for habitat enhancement projects.

<u>Ponderosa Pine</u>: Highly preferred by woodpeckers for nesting because of the rapid decay in the thick layer of sapwood; sapwood of other tree species is not sufficiently thick for woodpeckers to nest in. Existing cavities used by many secondary cavity nesters, including the flammulated owl, which is largely restricted to pine forests. Commonly used by woodpeckers, which forage in and under the bark. White-headed woodpeckers are particularly dependent on this tree species for nesting and foraging.

White fir: Snags frequently used as nest site by sapsuckers, nuthatches, and chickadees; occasionally used by pileated woodpeckers for nesting. Hollow snags extremely valuable to pileated woodpeckers for roosting at night, to black bears for hibernation, to American martens for dens and rest sites, and to bushy-tailed woodrats and flying squirrels for cover. Hollow logs are valuable as dens and rest sites for mammals such as black bears, American martens, squirrels, and other small mammals. Snags and logs used extensively by pileated woodpeckers and black bears for foraging on ants in the interior wood.

<u>Lodgepole pine</u>: Used by black-backed, three-toed, and hairy woodpeckers for nesting and foraging; rarely contains ants and is therefore seldom used by pileated woodpeckers for foraging in interior wood; pileateds may forage under the bark for mountain pine beetle larvae.

<u>Black cottonwood</u>: Valuable riparian species. Bole and branches commonly used for nest cavities by northern flickers and Lewis' woodpeckers because of the soft decayed wood. Used by pileated woodpeckers for nest and roosting in Montana. Old woodpecker cavities and natural cavities located on the bole at branch scars used by many secondary cavity nesters, including western screech owls and northern saw-whet owls.

<u>Quaking aspen</u>: Commonly used for nest cavities by woodpeckers, sapsuckers, and secondary cavity nesters because of the soft decayed wood.

Table 13. Snag and log considerations and habitat requirements for selected special interest species.

species.	
Species	Habitat Requirements
Bald Eagle	• All forest land within 1.6 km (1 mile) of major water bodies is potential eagle nesting habitat. (Payne and Bryant, 1994).
	• Favorite perch trees are large diameter snags, dead topped trees, 80 to 100 feet high, lodgepole and jeffrey pine species, with large, multiple lateral branches (USFS 1979).
California Spotted Owl	• Nesting: snags with basal area of 20 - 25 square feet per acre, logs 3 - 5% ground covered.

Species	Habitat Requirements
	 Foraging: snags with basal area of 15 - 25 square feet per acre, logs 3 - 5% ground covered (USFS 1993). Nest trees: natural cavities from decay, broken topped trees and snags, platforms, dwarf mistletoe brooms (USFS 1993). Flying squirrels (main prey) nesting preferences: snags >35 in dbh (USFS 1993). In general, preference specifics: >24" dbh, >20 ft high; logs 5-20 logs per acre, >20" diameter, >40 cubic feet in volume per acre (USFS 1993). California spotted owl nest occur with increases in basal area of live trees, number of snags, and total canopy closure (Bas and Gutierrez 1992).
Long-toed salamander (Ambystoma macrodactylum)	 Adults use rocks and down logs for cover near breeding sites during breeding season (late spring and early summer), especially large logs. Species occurs near temporary and permanent ponds, wet meadows (Schlesinger 1999).
Pileated Woodpecker	 Pileated woodpecker is a USFS Management Indicator Species (MIS). Prey: carpenter ants and wood-boring beetles in snags and logs (Bull and Jackson 1995). Carpenter ants prefer larger diameter (>38 cm diameter) logs, do not like lodgepole, prefer mid-decomposition stage logs, and avoid demobilization classes 4 and 5 (Torgersen and Bull 1995, Bull et al., 1997). Nests are in stands of greatest basal area near streams in mesic stands. Decay in trees important, prefers decayed logs > 38 cm diameter (Bull and Jackson 1995). Home range is 400 - 500 ha (McClelland 1977, Bull and Jackson 1995). USFS in Oregon and Washington maintain 120 ha habitat in old growth stands and 120 ha with >5 snags per ha for foraging, plus green trees for snag recruitment (Bull and Jackson 1995). Pileated woodpeckers strongly favor broken top trees for nesting and roosting and are site tenacious. Cottonwood snags important, but are short-lived (10 to 20 years) (McClelland 1977).
Pine Marten (Martes americana)	 Marten den structures: rock crevices snags, middens, and logs. Subnival access to prey in winter critical and provided by clumps of jackstrawed logs. Snags 20 to 40cm dbh and greater, and hard logs >41 cm diameter important (Ruggiero et al., 1998).

Table 14. Territory size and minimum nesting snag requirements for representative snagdependent species (modified after USFS, 1980).

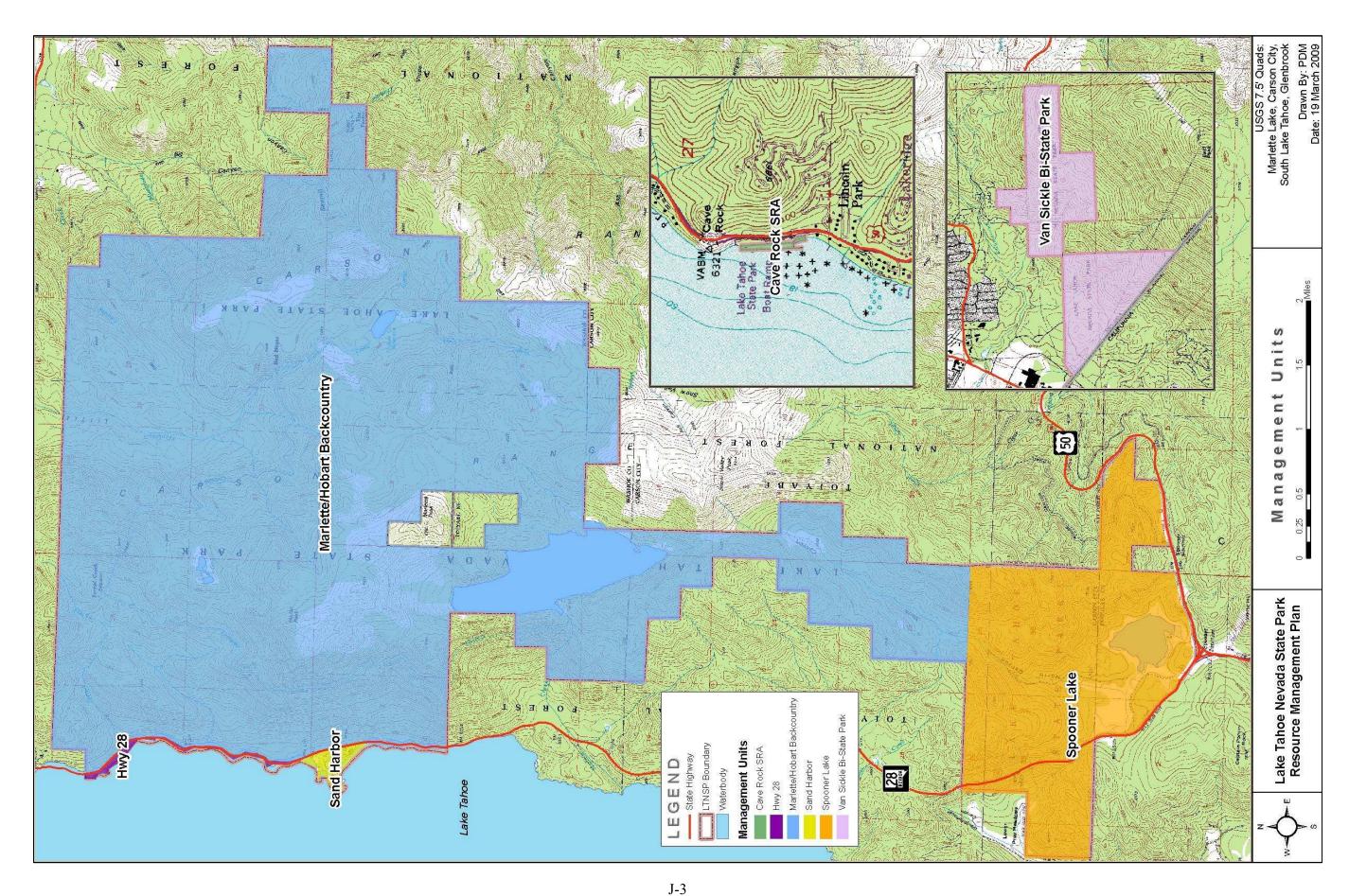
Snag Dependent Species	Territory Size (ac)	Max Nesting Pairs/Acre	Snags/ Pair	Recruit Snags Needed	*Snags per Acre, 100% pop	Min DBH (in)	Min Ht (ft)
Pileated Woodpecker	300	0.003	3	12	0.2	20	40
Common Flicker	40	0.025	1	5	0.4	12	10
Lewis Woodpecker	15	0.067	1	5	1.0	12	40
Yellow-bellied sapsucker	10	0.100	1	5	1.5	10	20
Hairy Woodpecker	25	0.040	3	12	1.8	10	20
Downy Woodpecker	10	0.100	2	8	3.0	6	20
White-headed Woodpecker				2.4	0.6	10	6

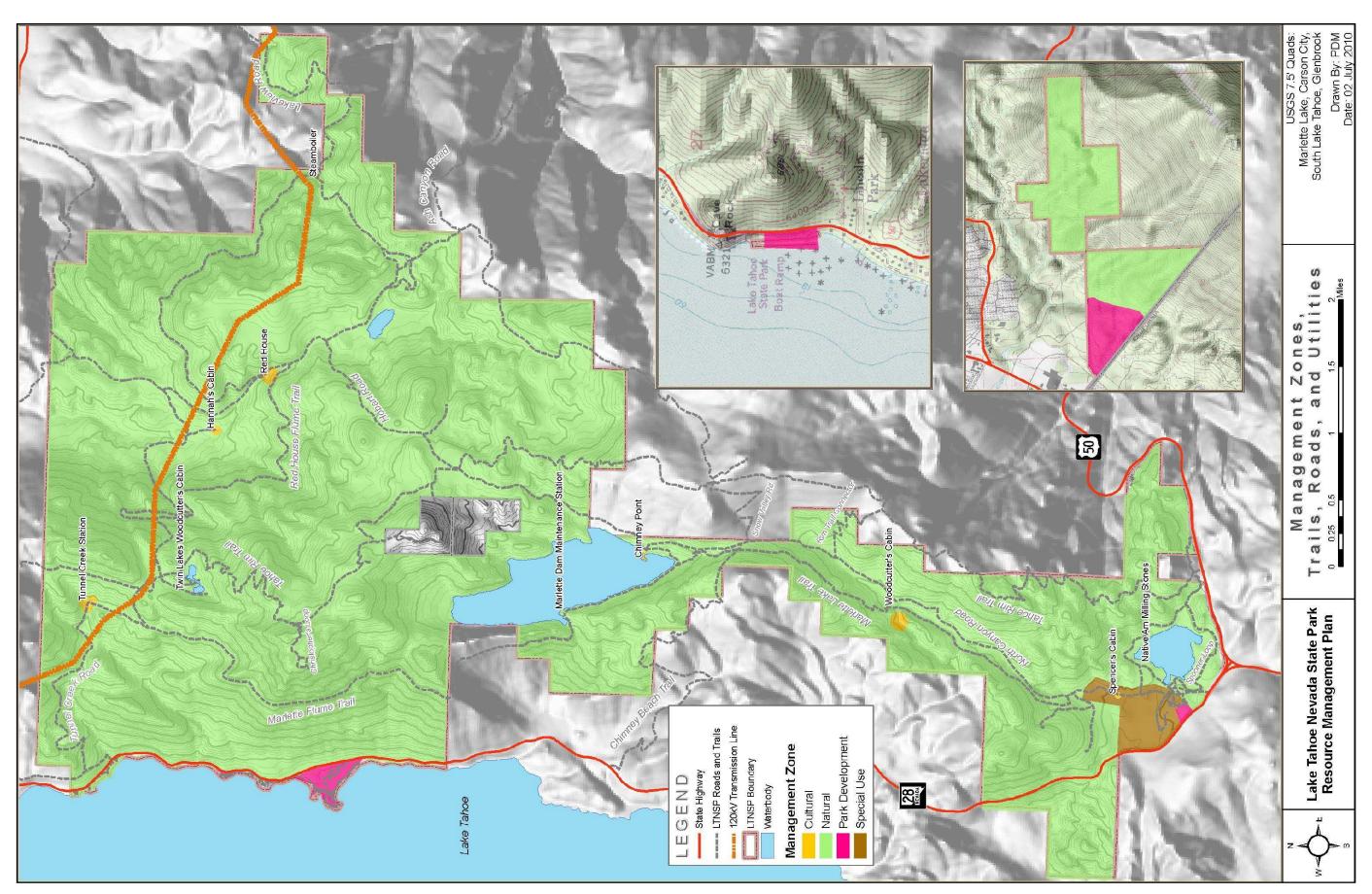
^{*}Minimum number of nesting snags per acre needed to maintain 100% population level for a given area.

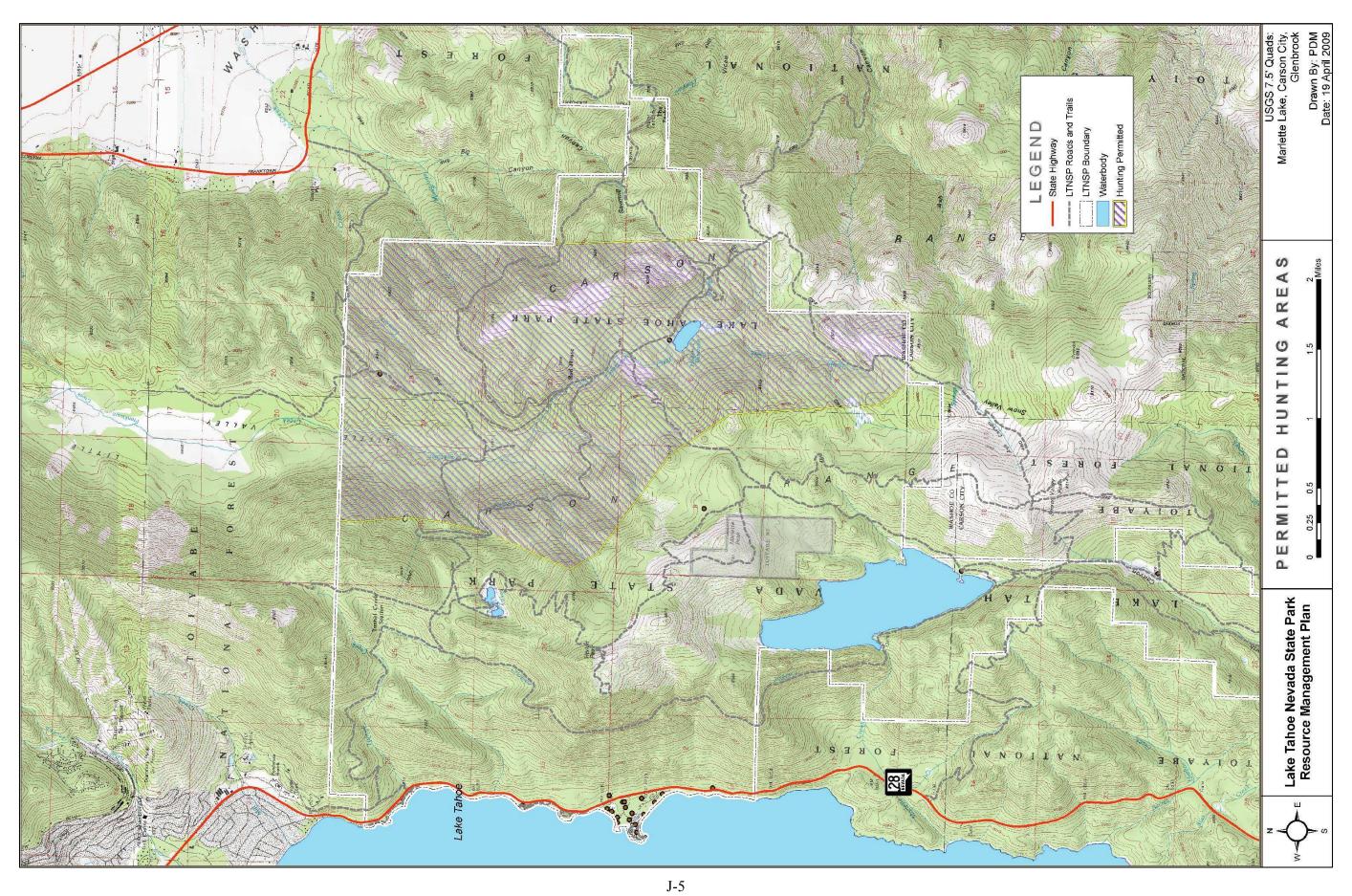
Appendix J - Maps

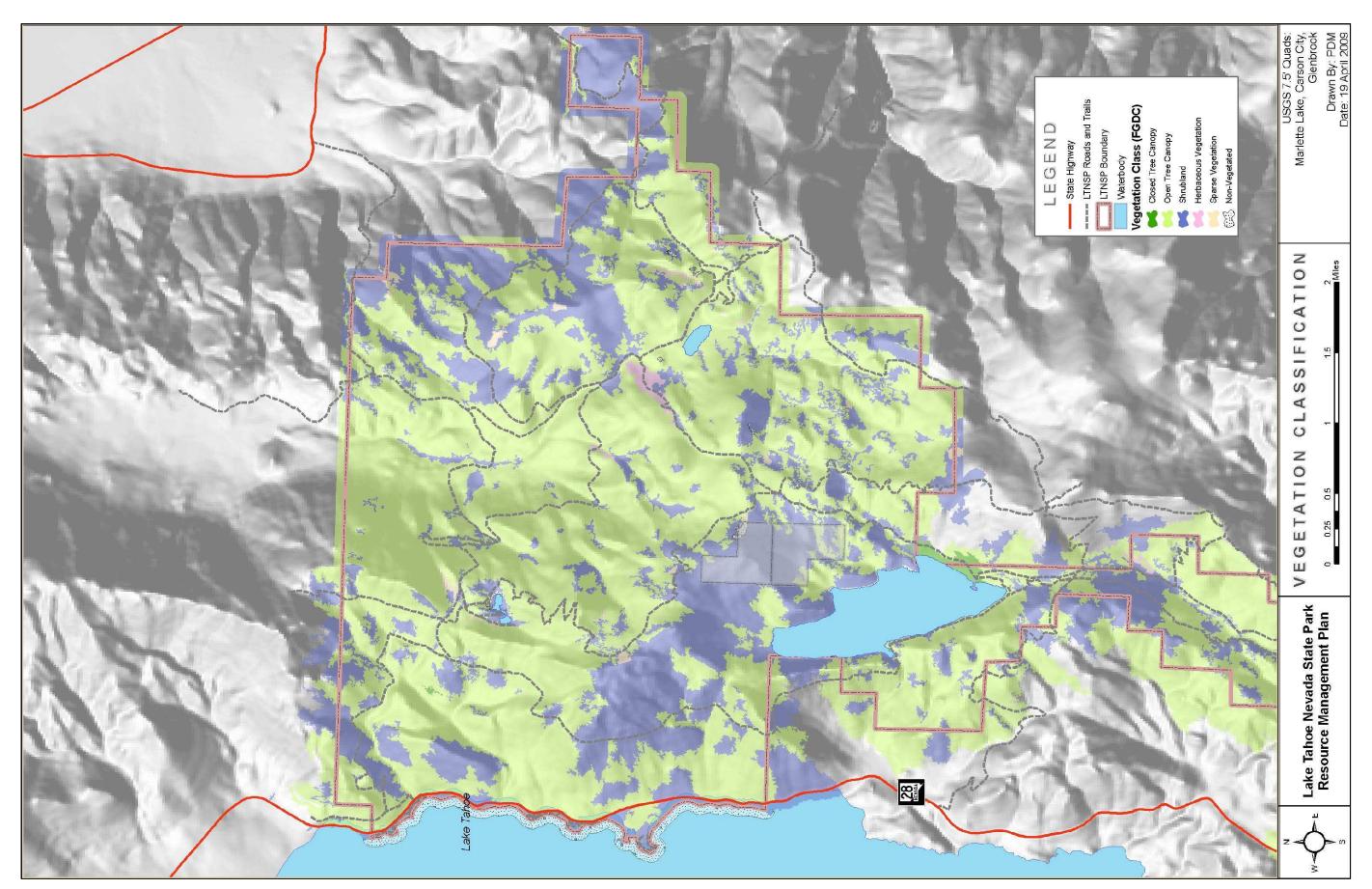
•	Location	J-2
•	Management Units	J-3
•	Management Zones	J-4
•	Allowable Hunting and Fishing Areas.	J-5
•	Vegetation Classification	J-6
•	Late Successional/Old Growth Forest Stands	J-12
•	Invasive Species	J-15
•	Tahoe Yellow Cress Occurrences	J-16
•	Soil Units – Soil Map Unit numbers (MUSYM) are displayed for each soil unit. Corresponding descriptions of the soil units are found in Appendix B.	J-18
•	Geology	J-23
•	Land Capability	J-28
•	Water Resources	J-33
•	Wildlife Habitat Resources	J - 39
•	Primary Cultural Resources	J-42
•	Historic Fire Occurrences	J-44
•	East Slope Forest Management Priorities and Management Projects	J-46
•	Lake Tahoe Basin Hazardous Fuels Strategy Treatment Priorities	J-48

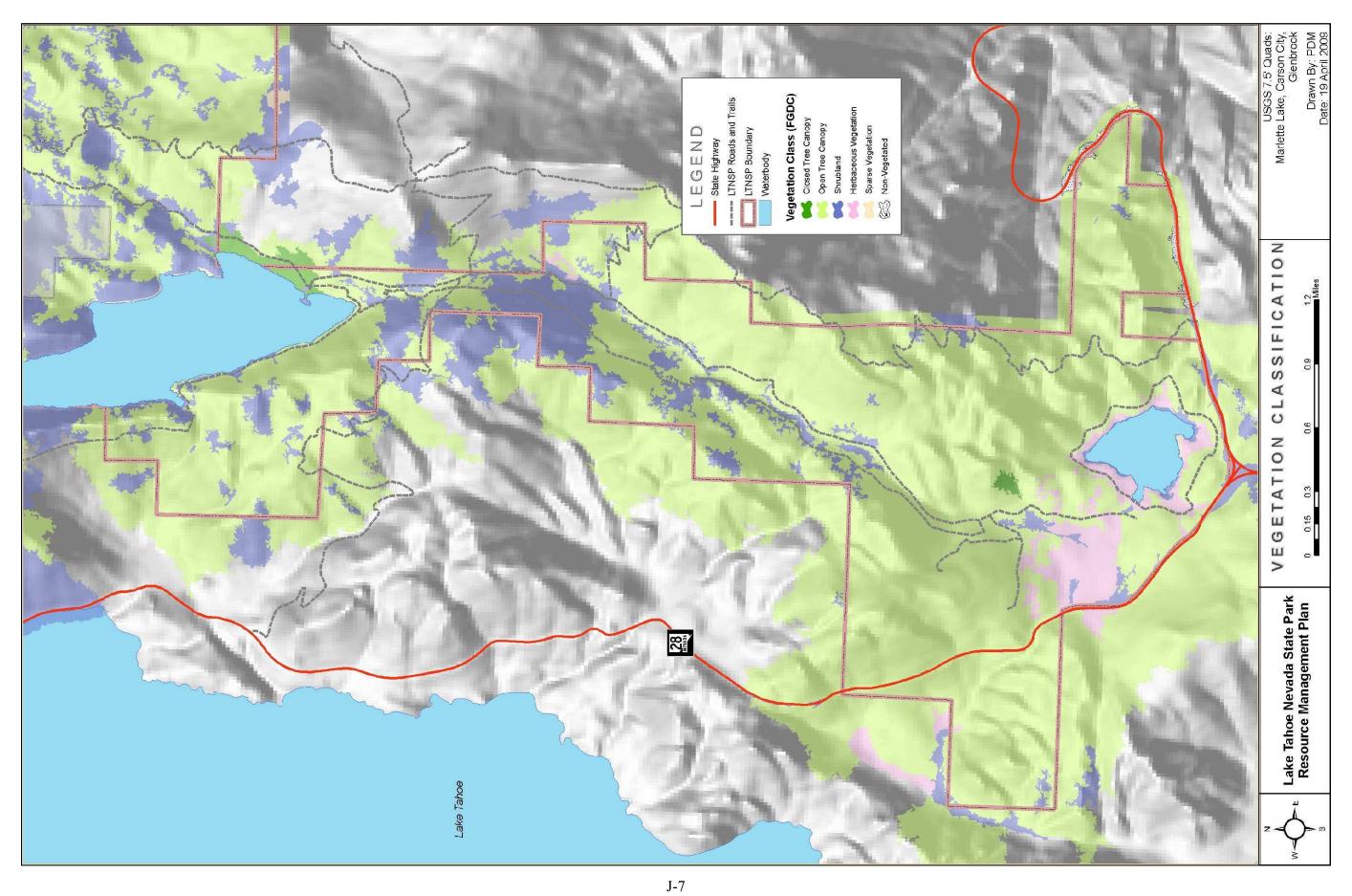


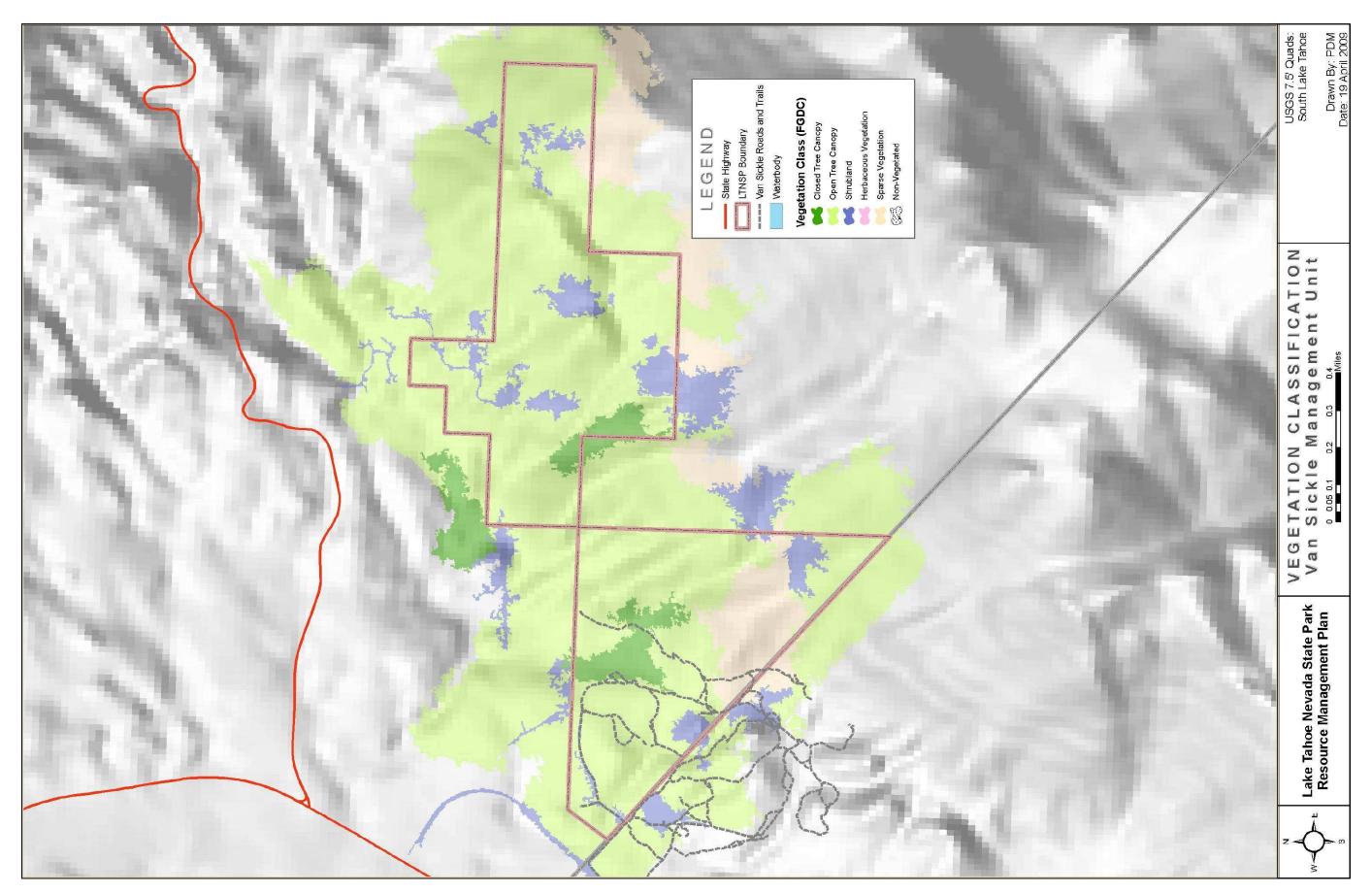


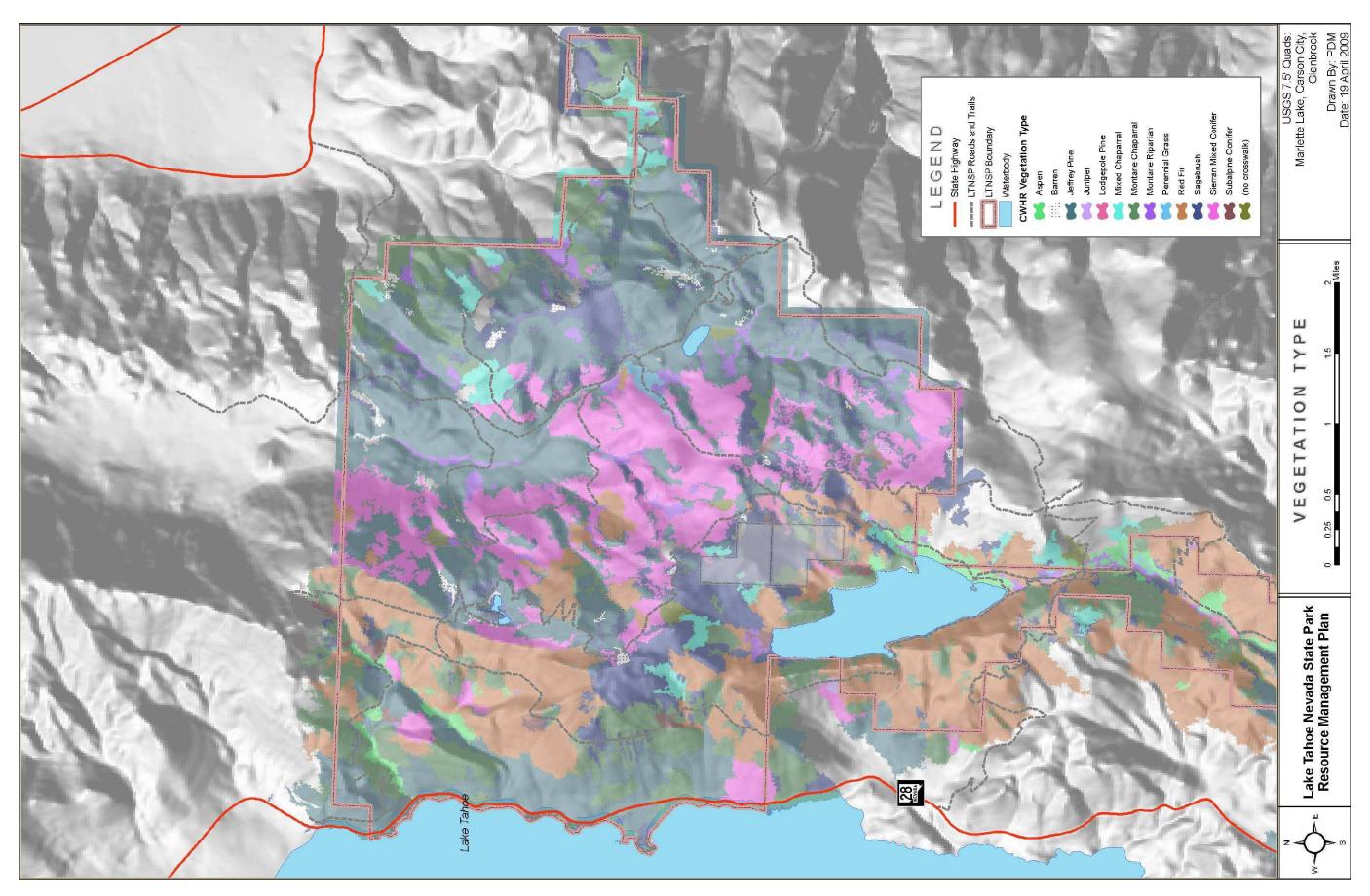


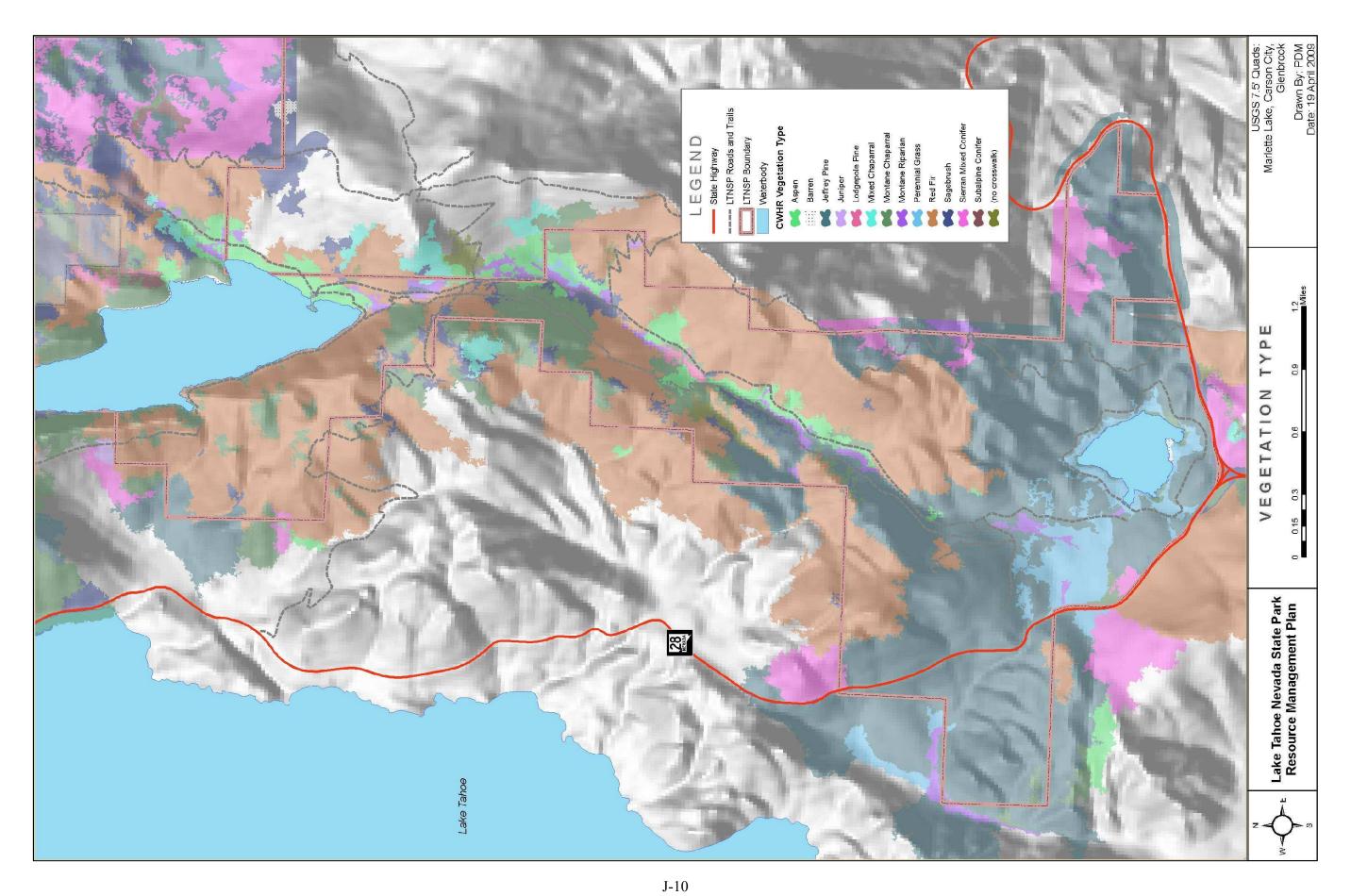


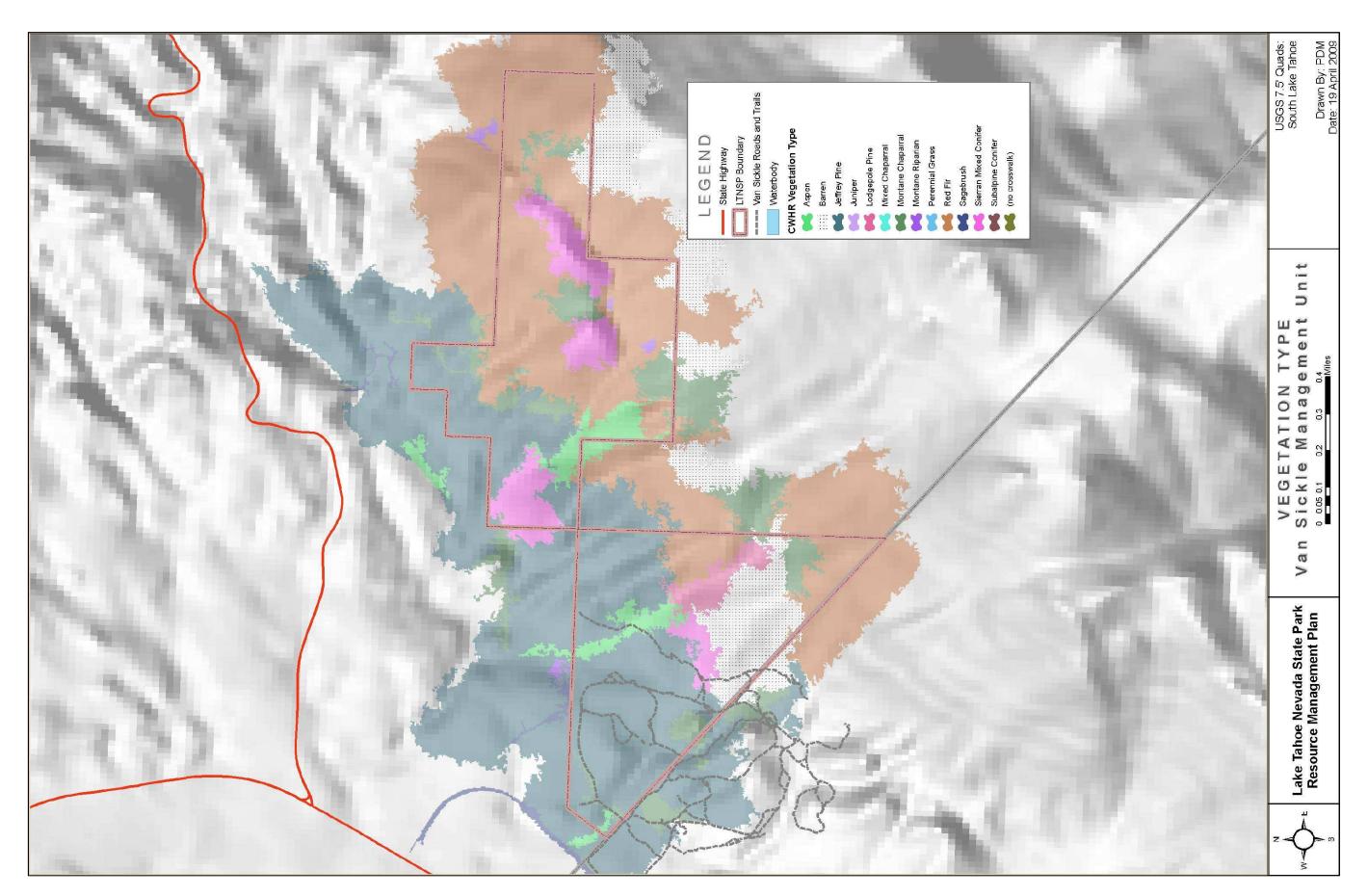


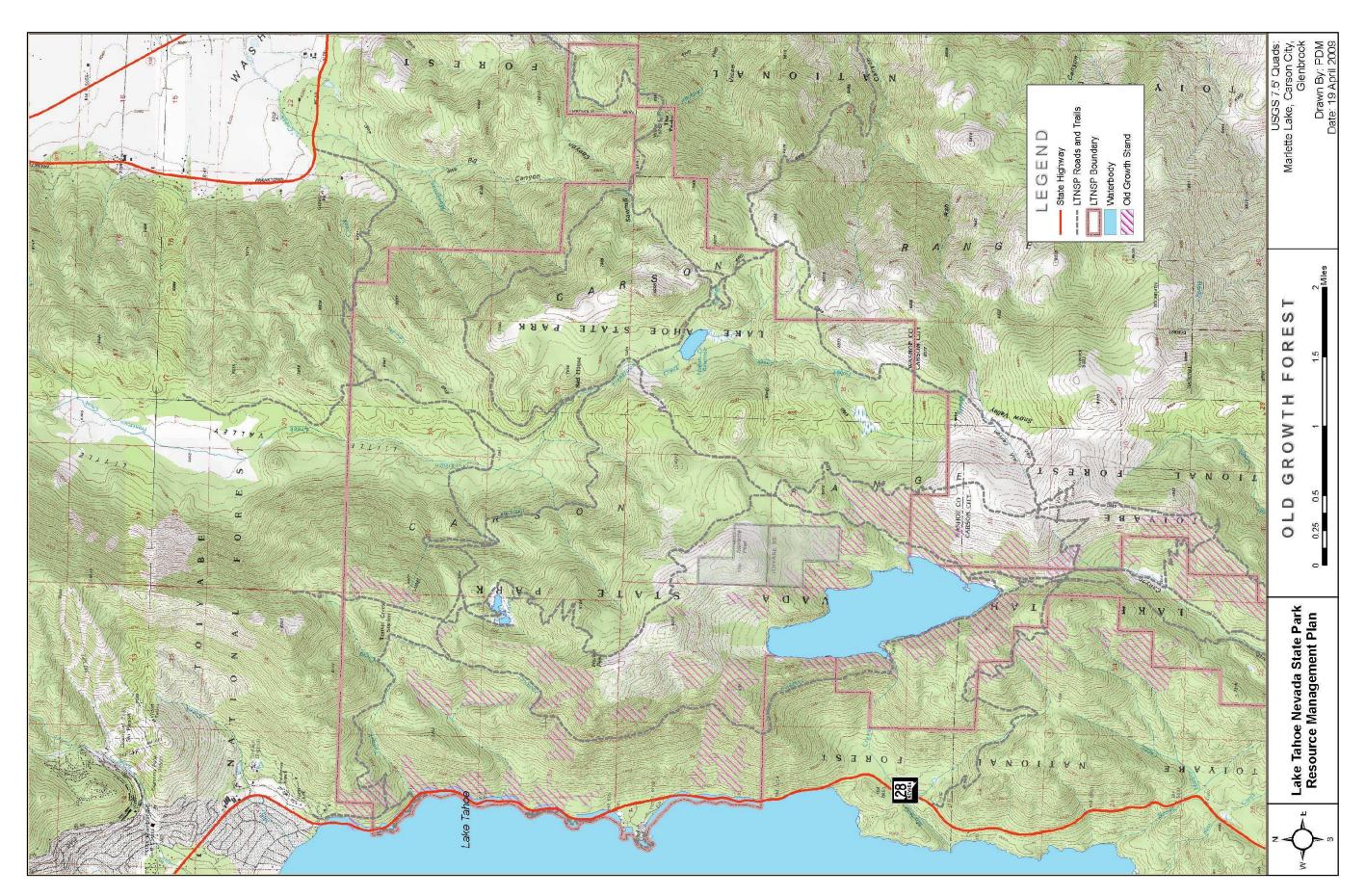


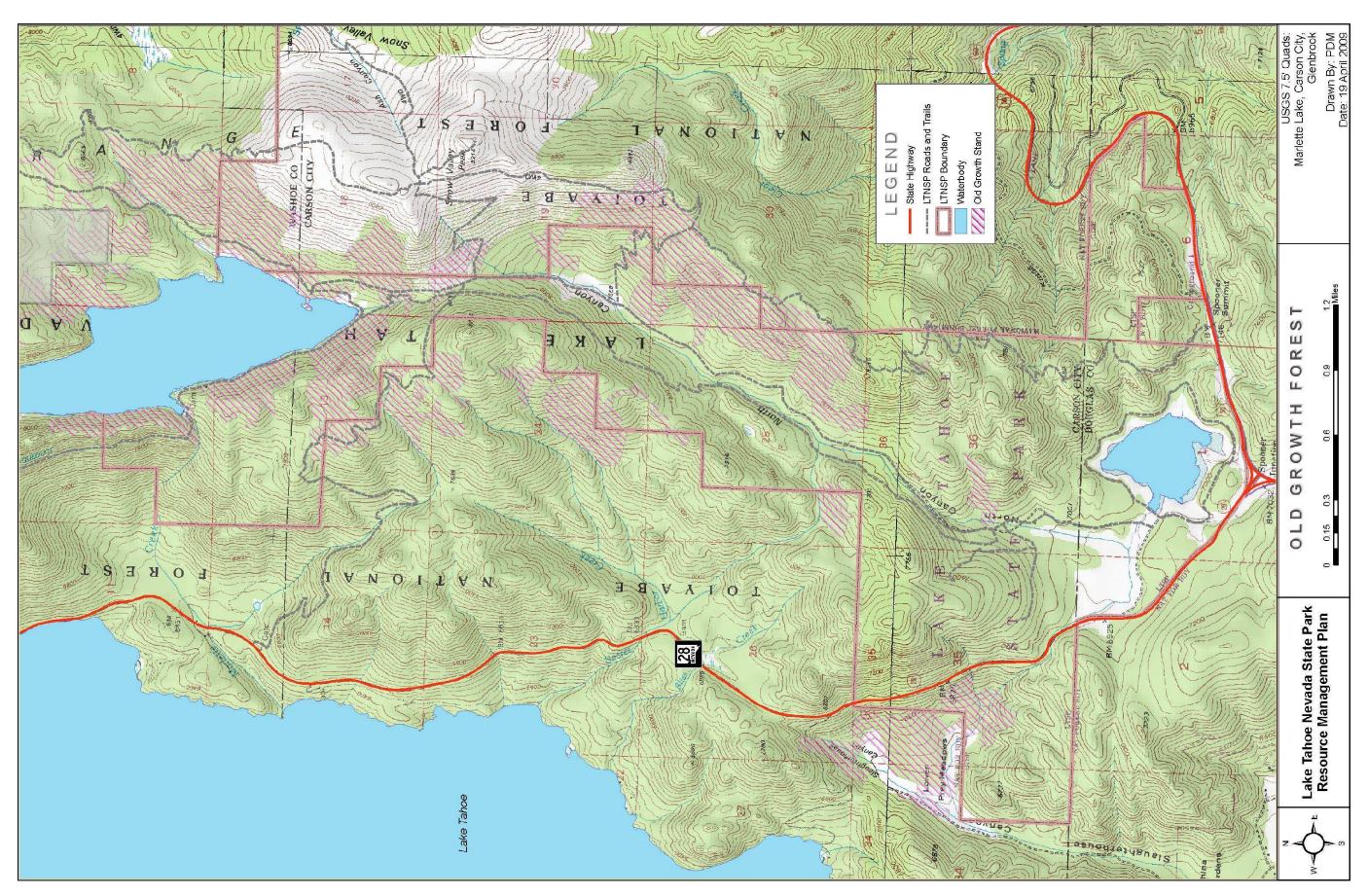


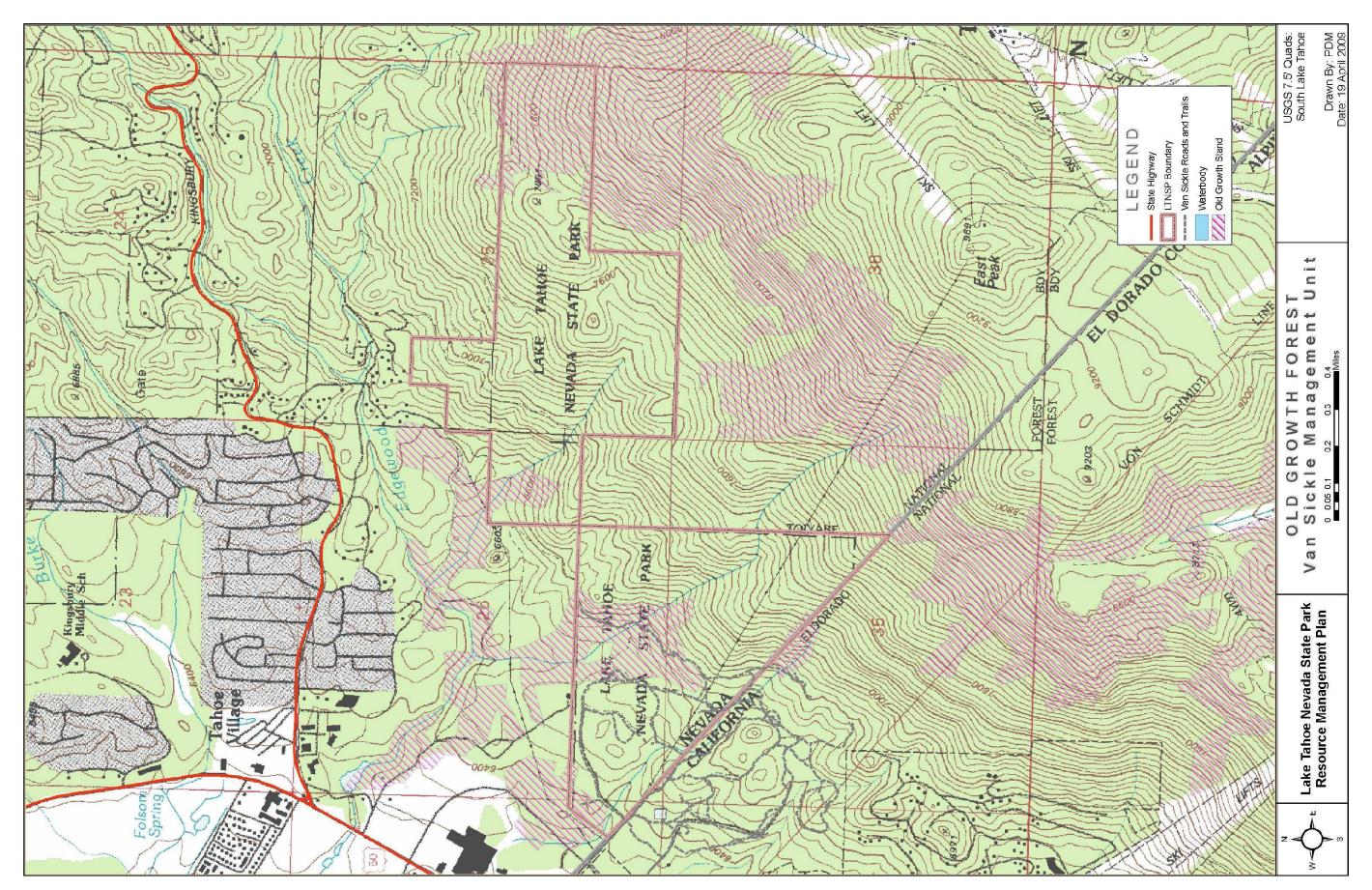


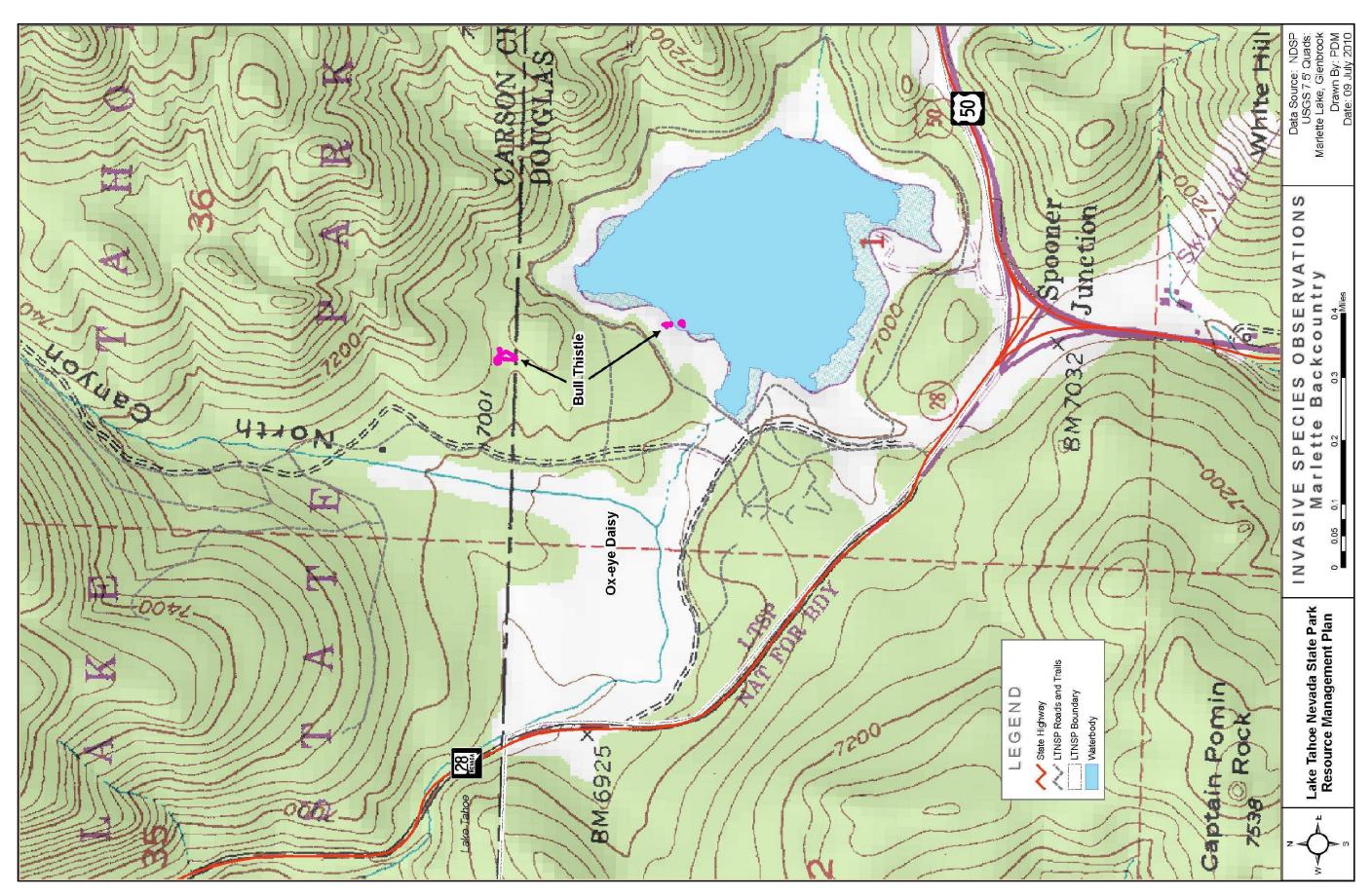


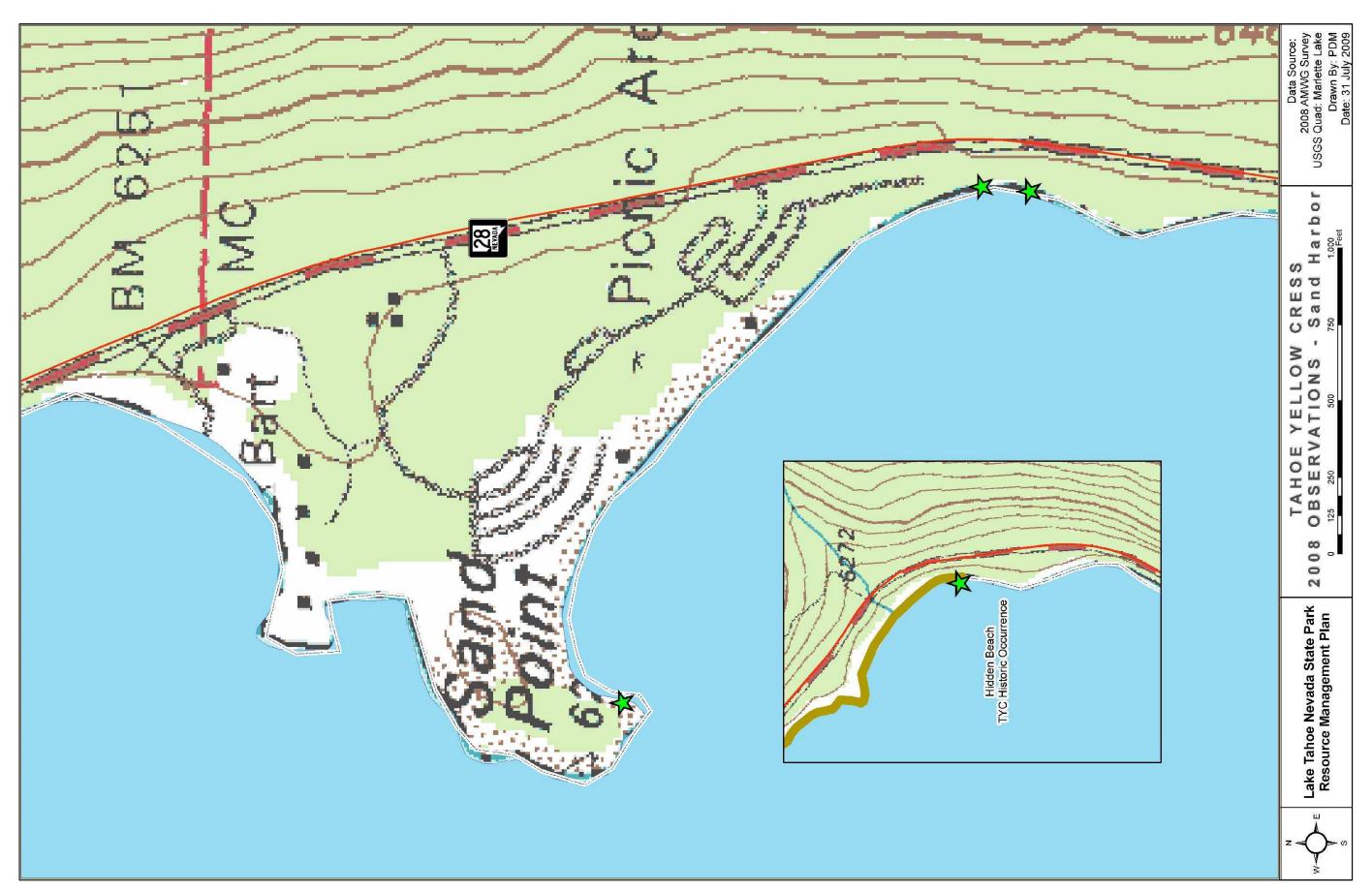


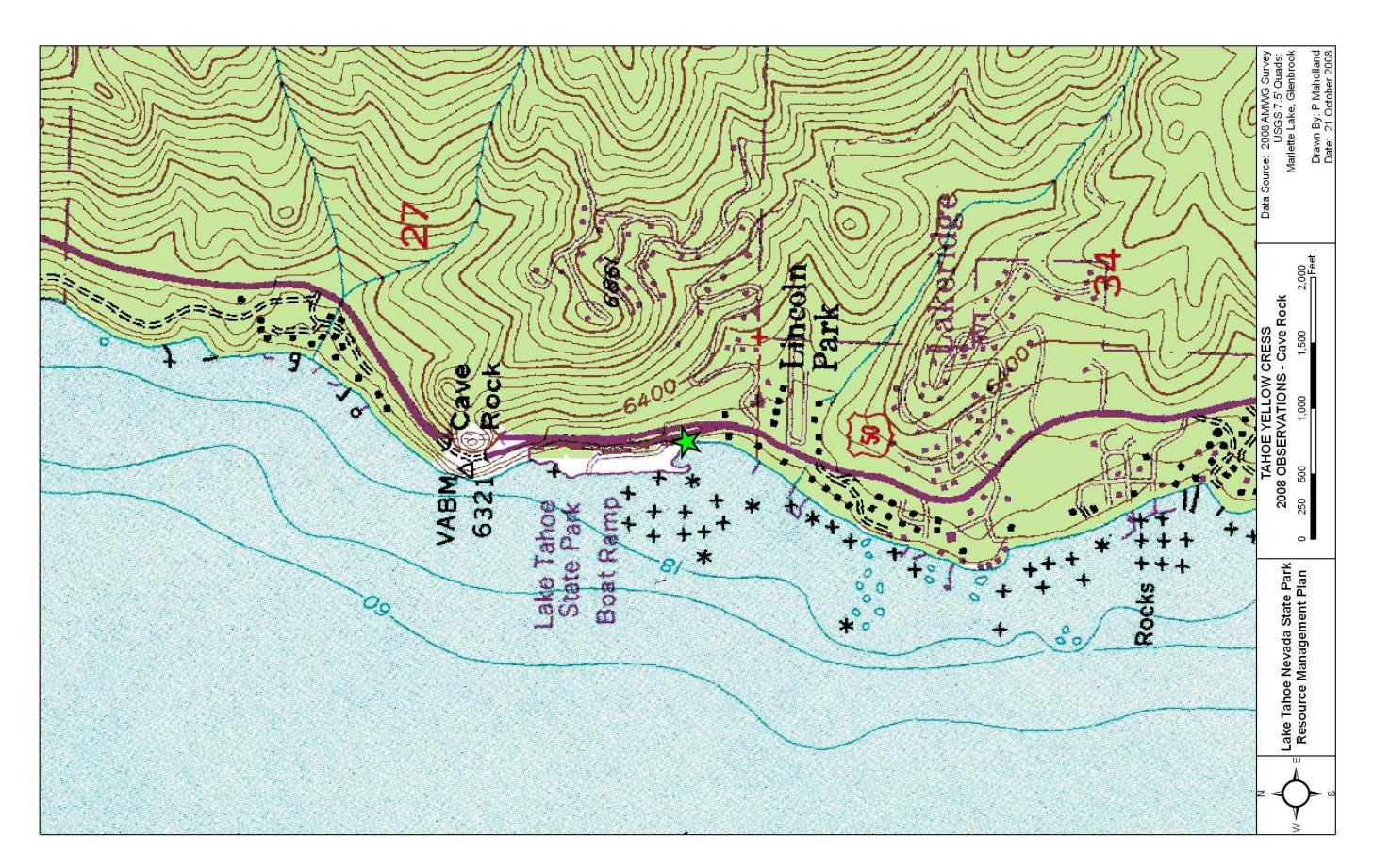


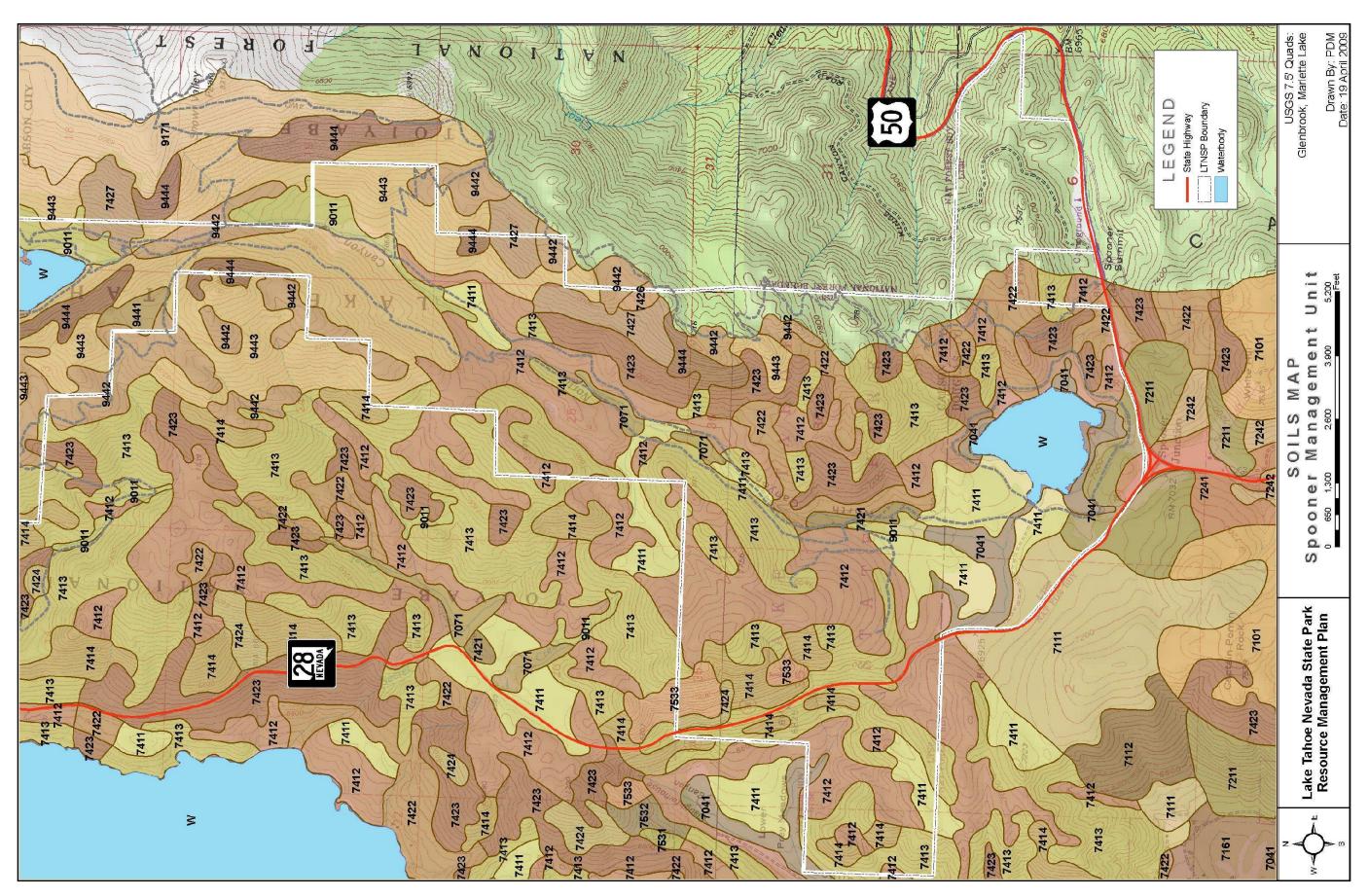




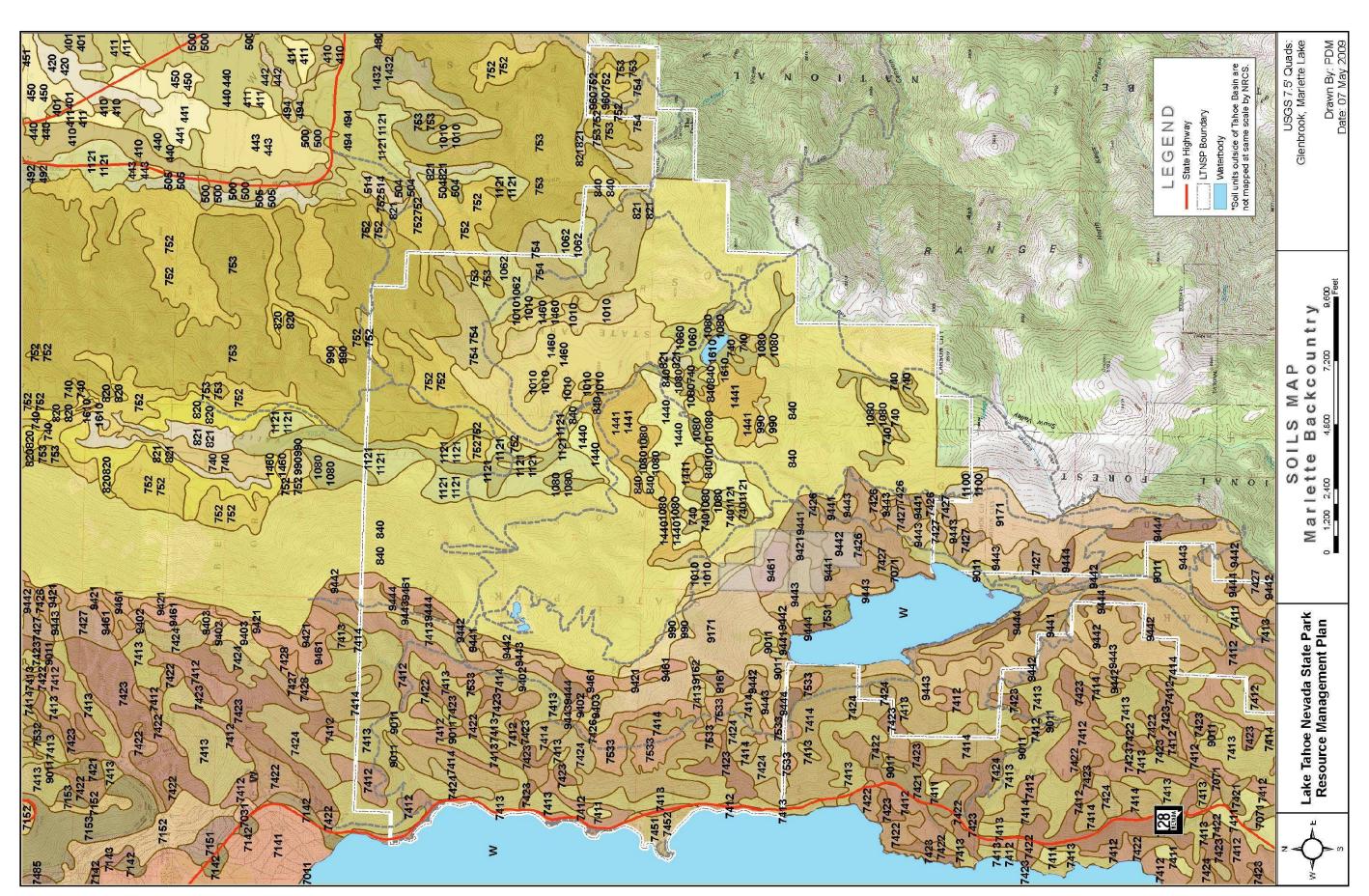




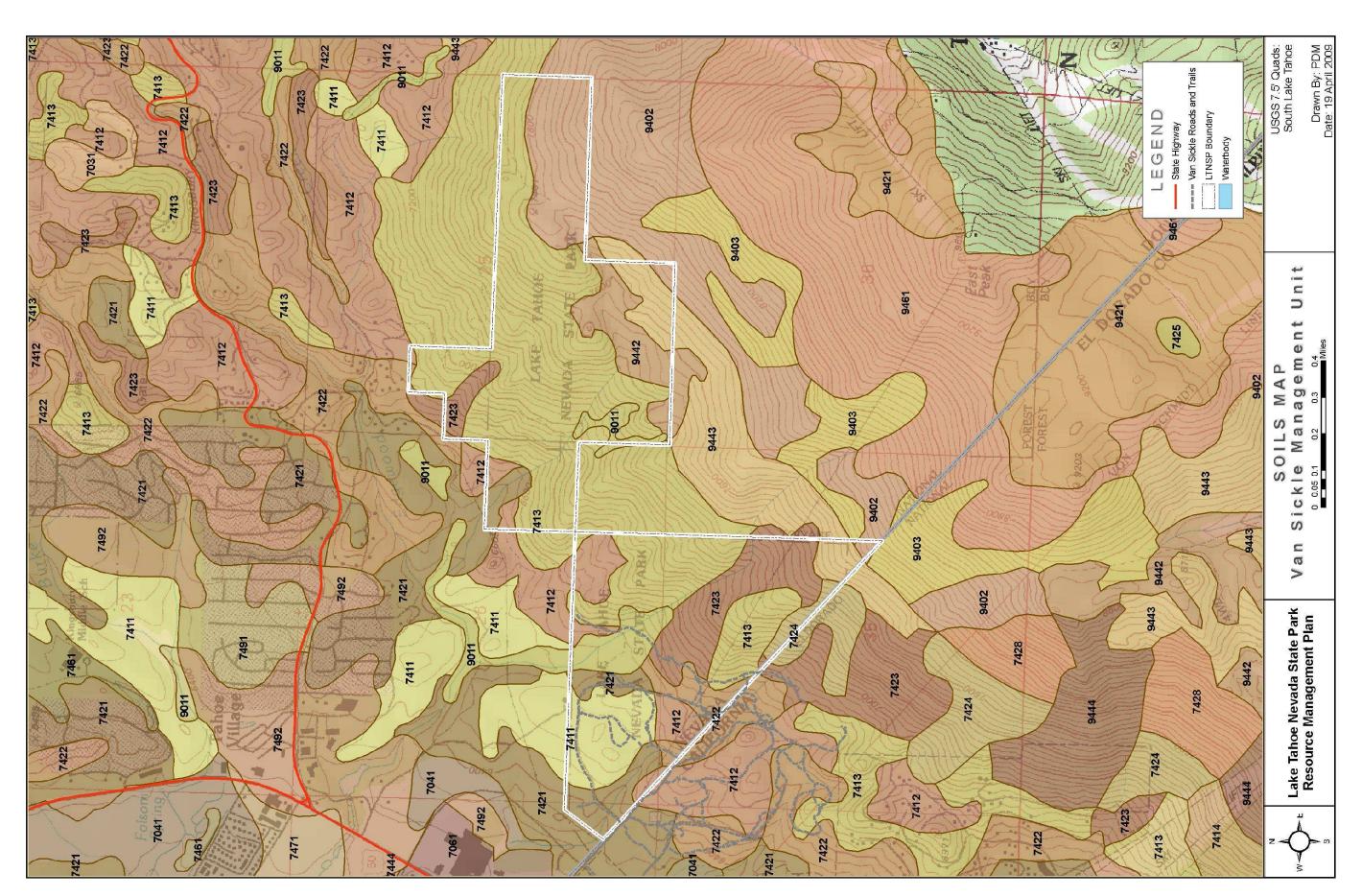


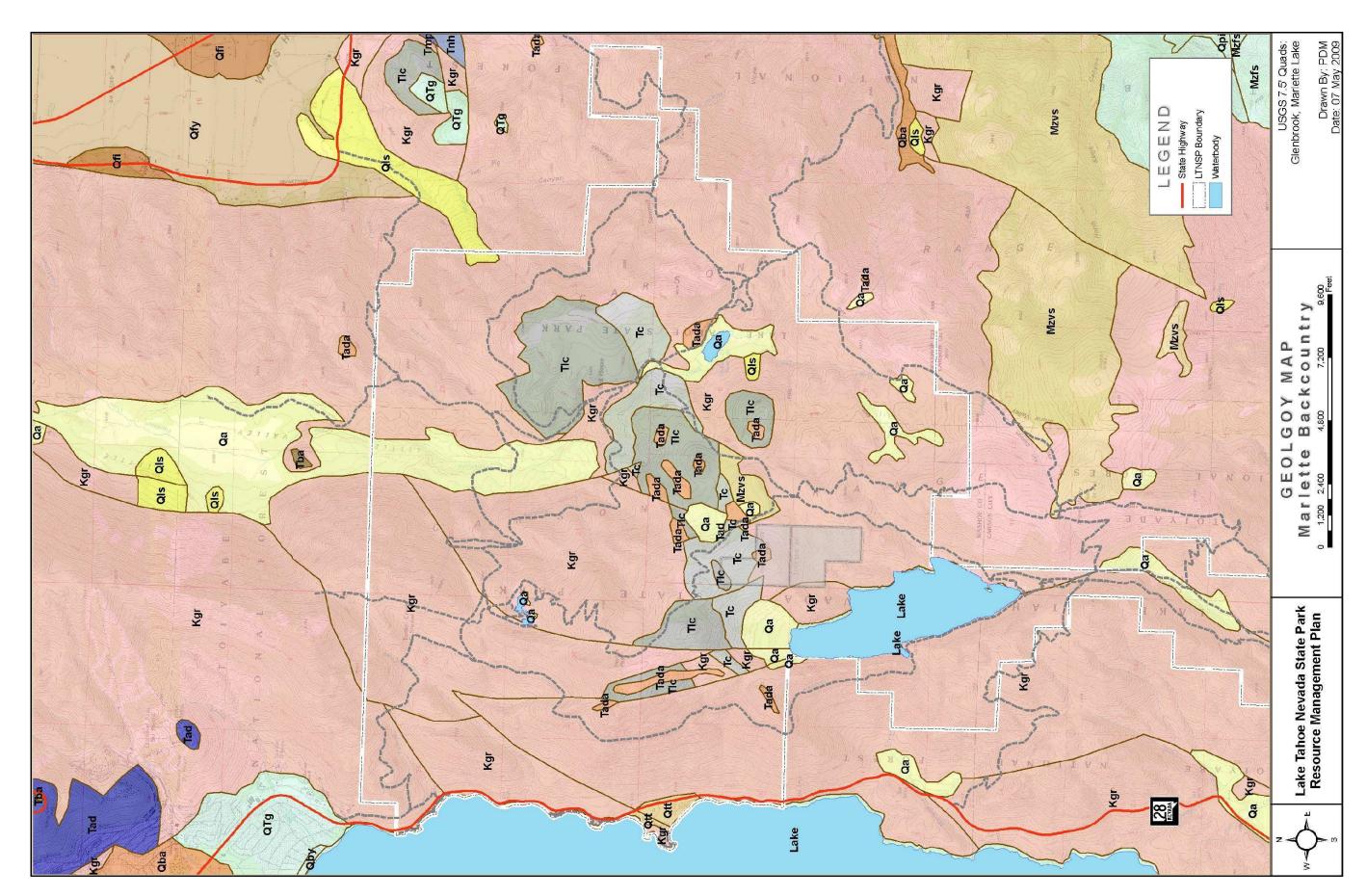


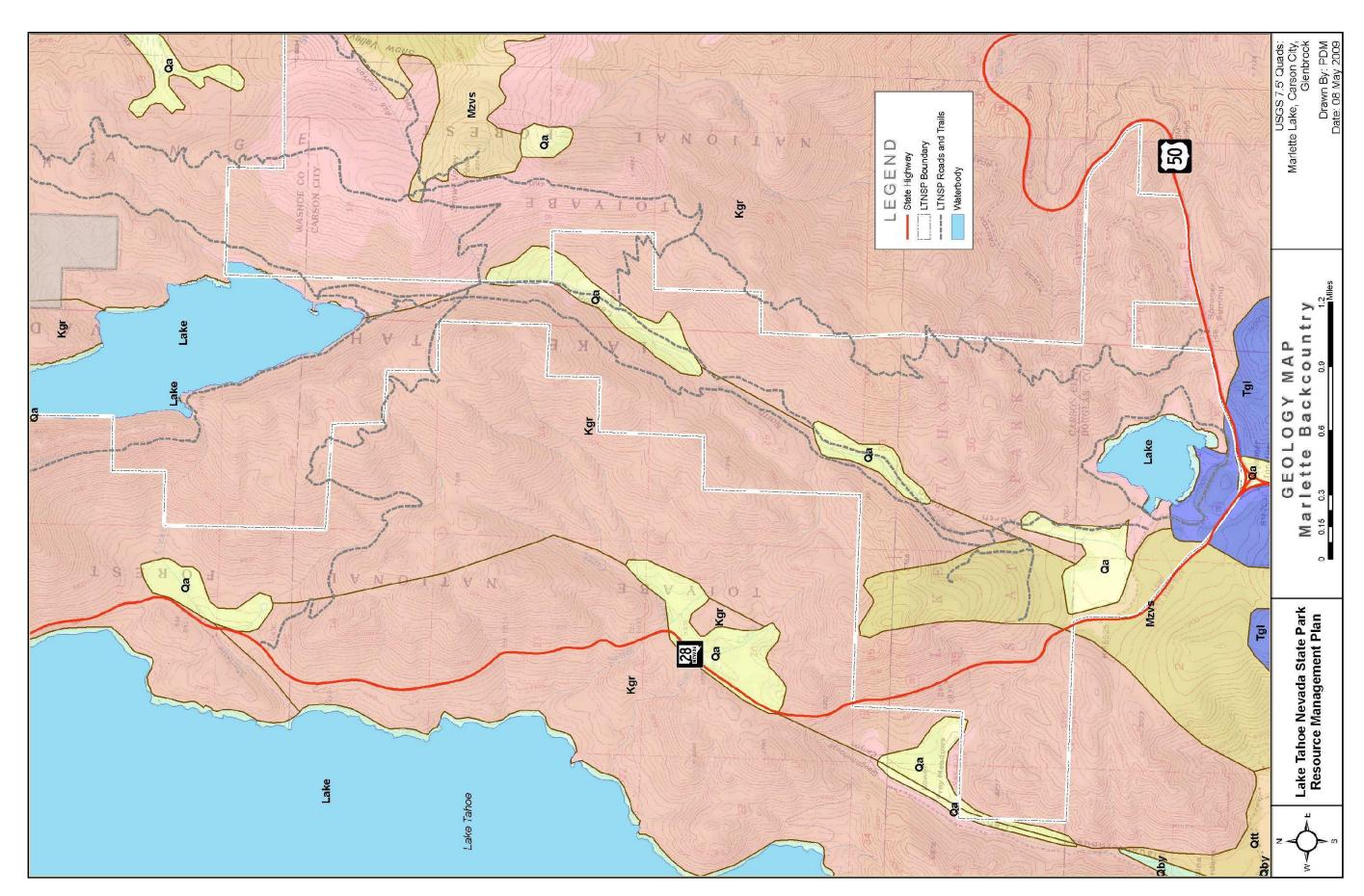


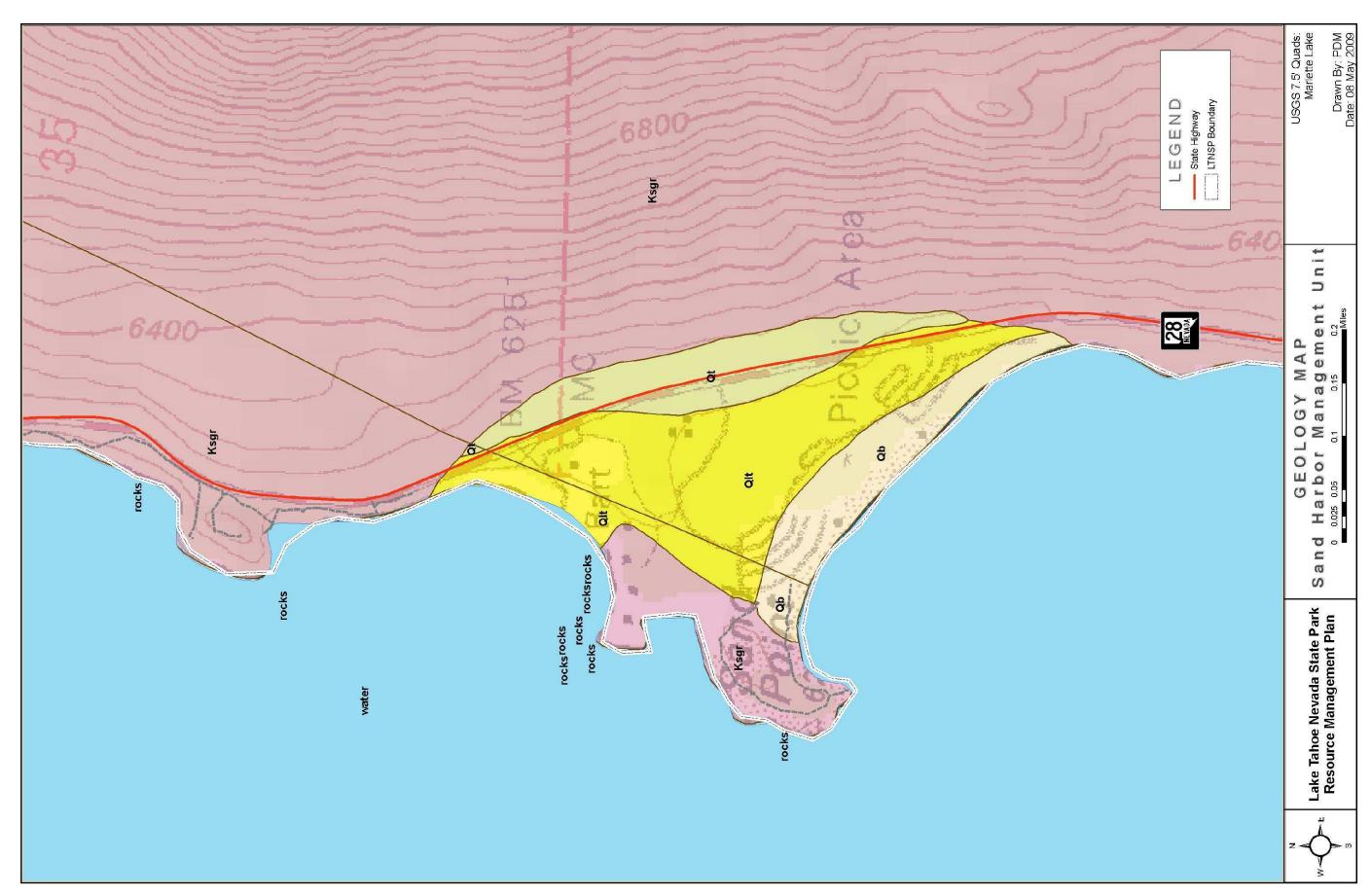


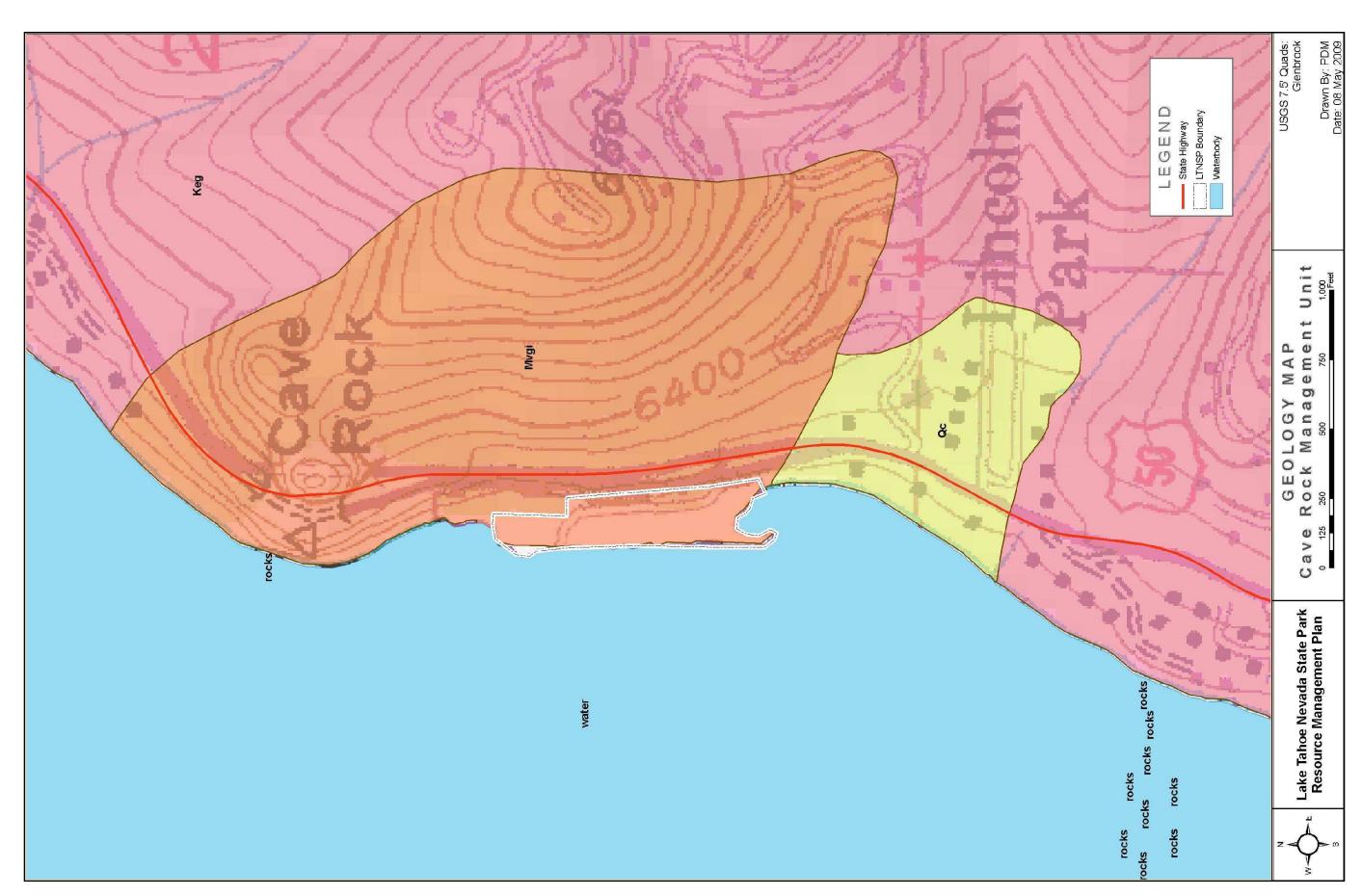


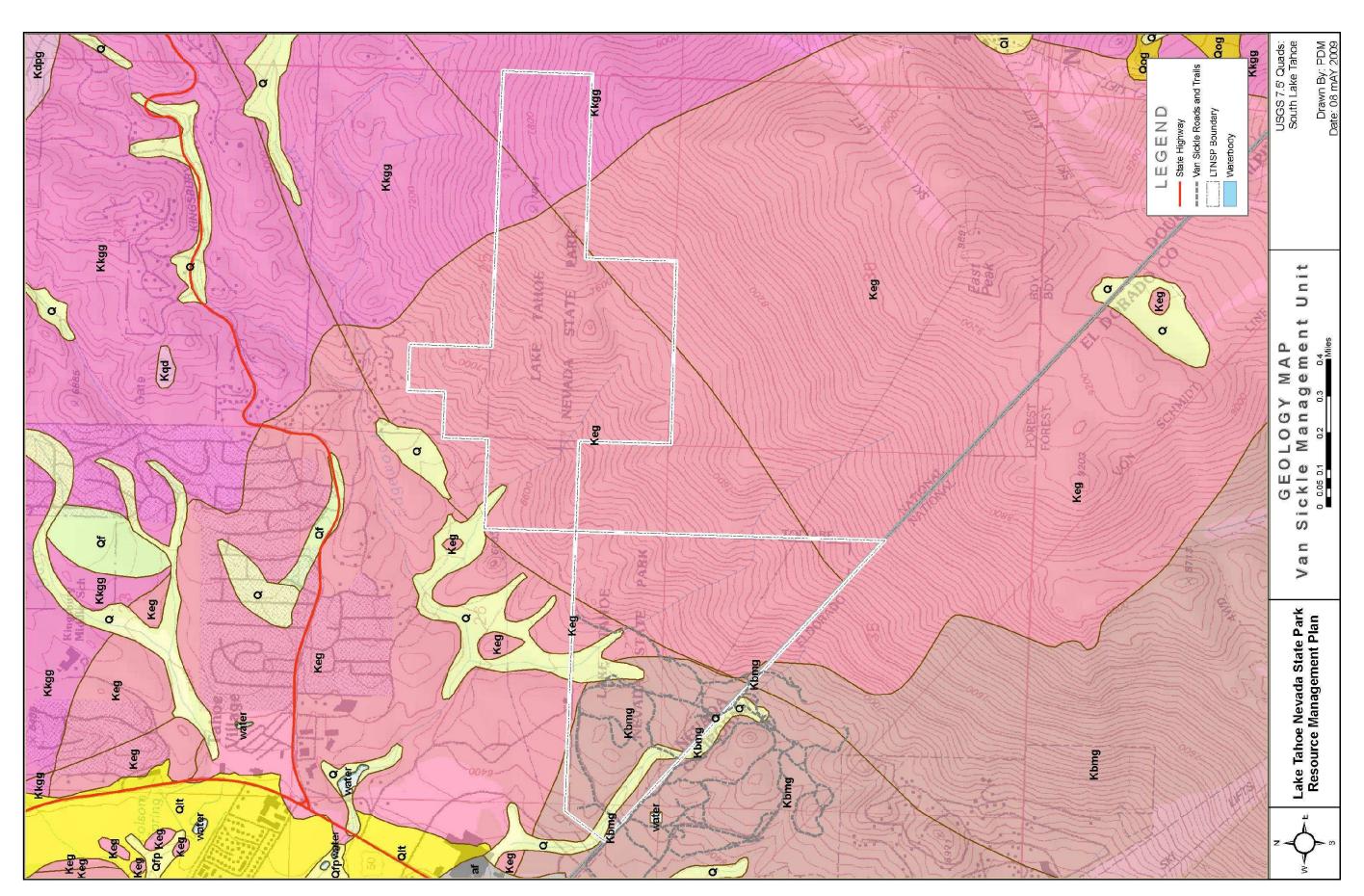


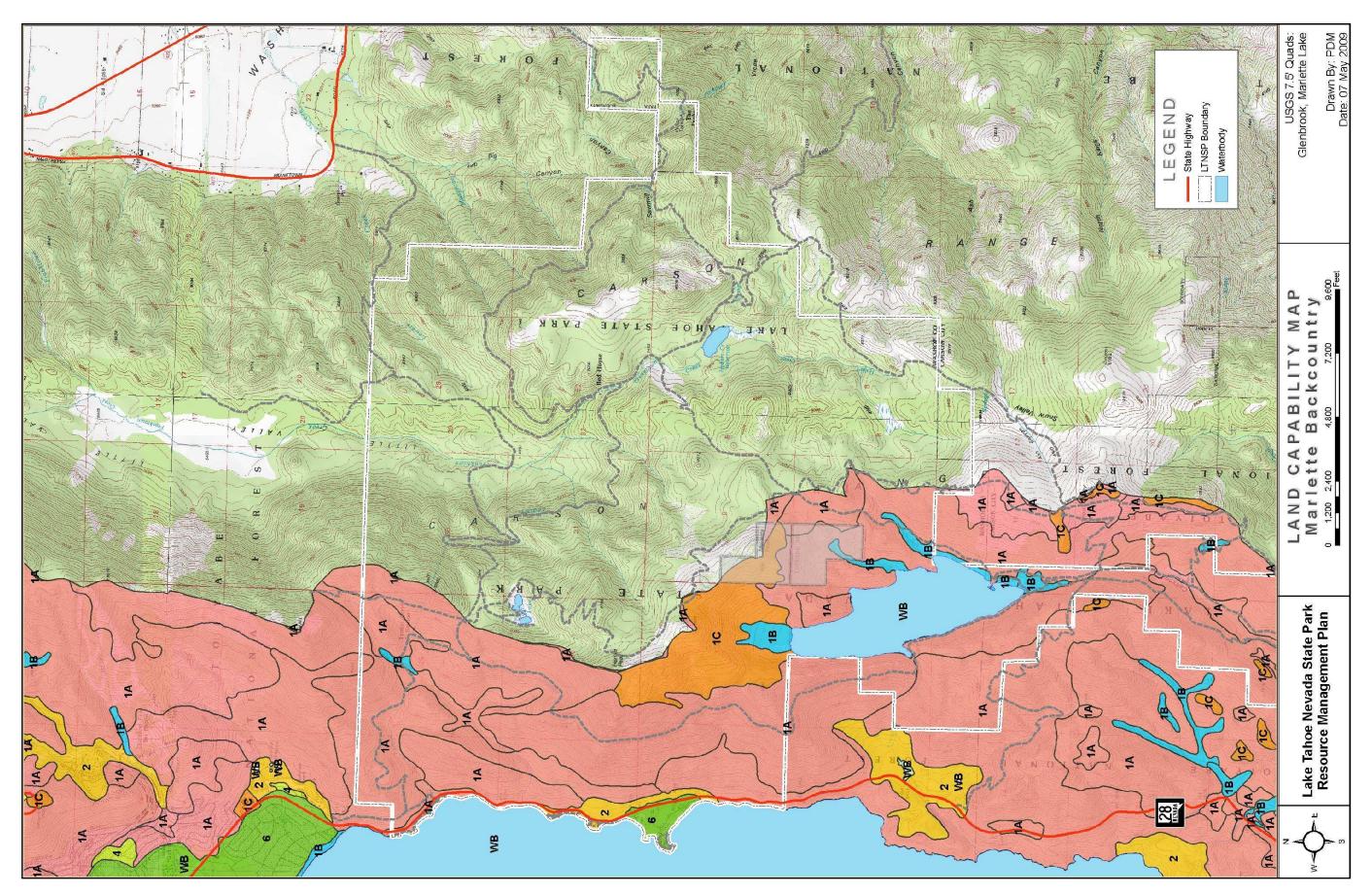


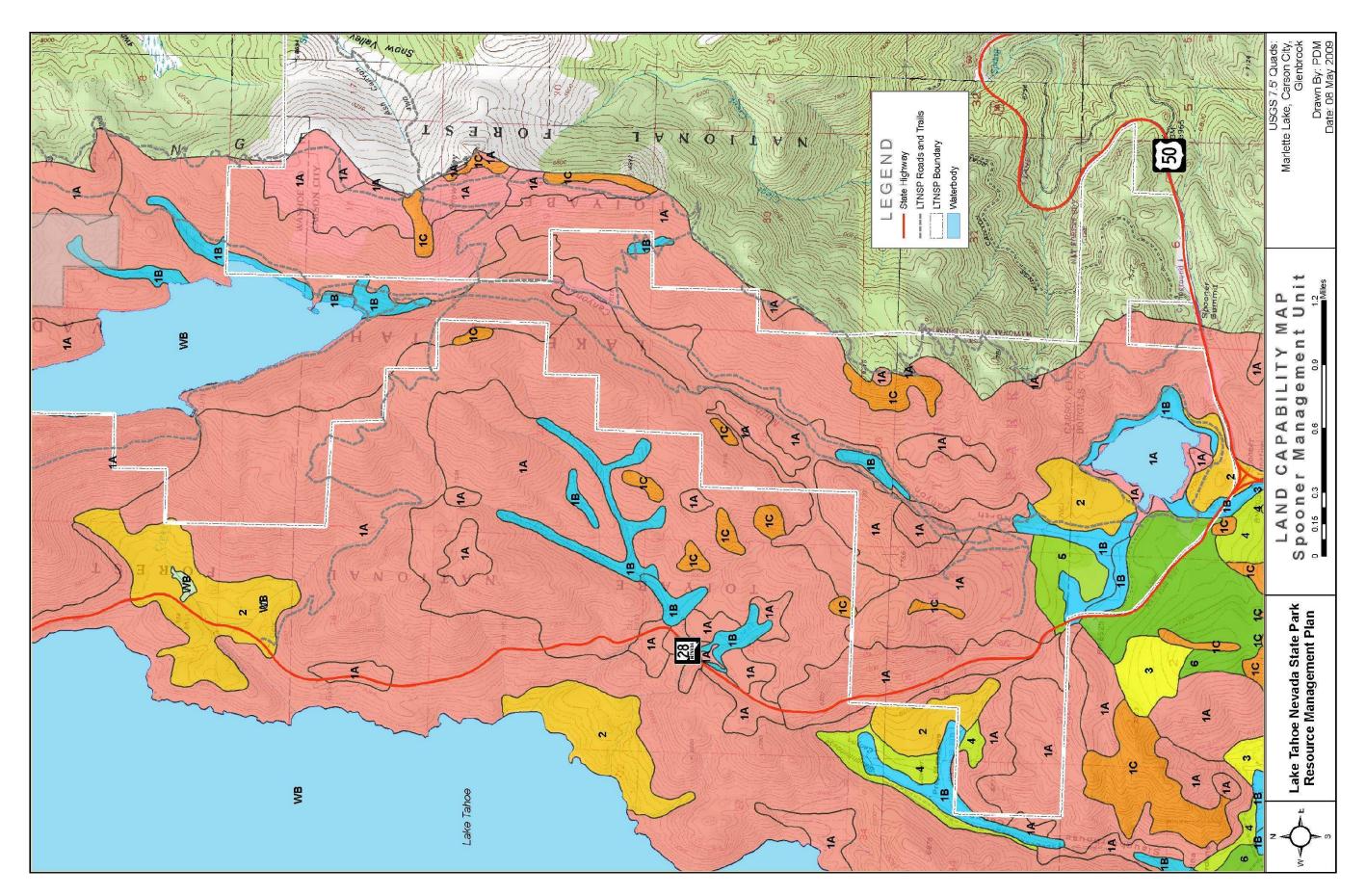


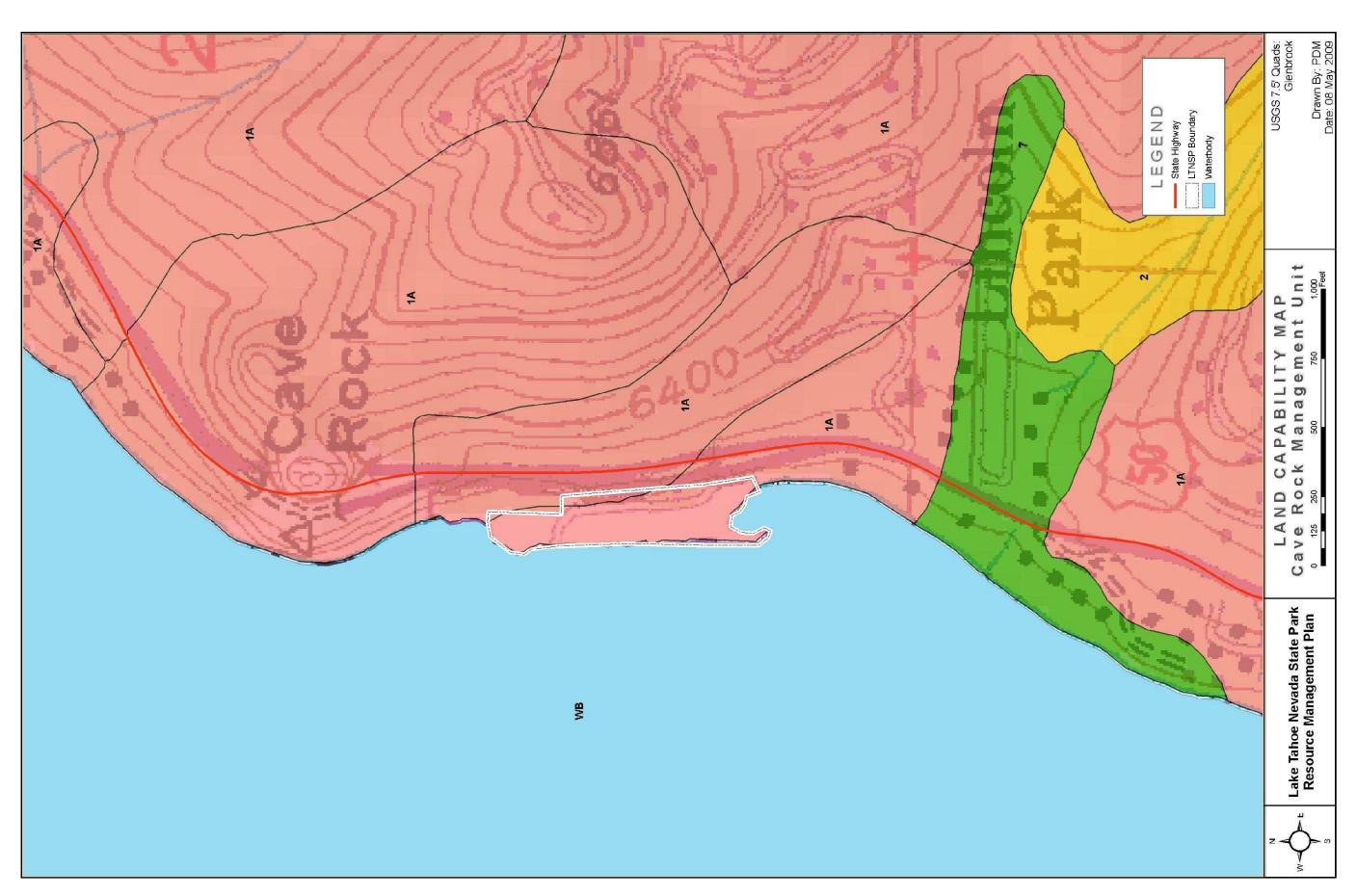


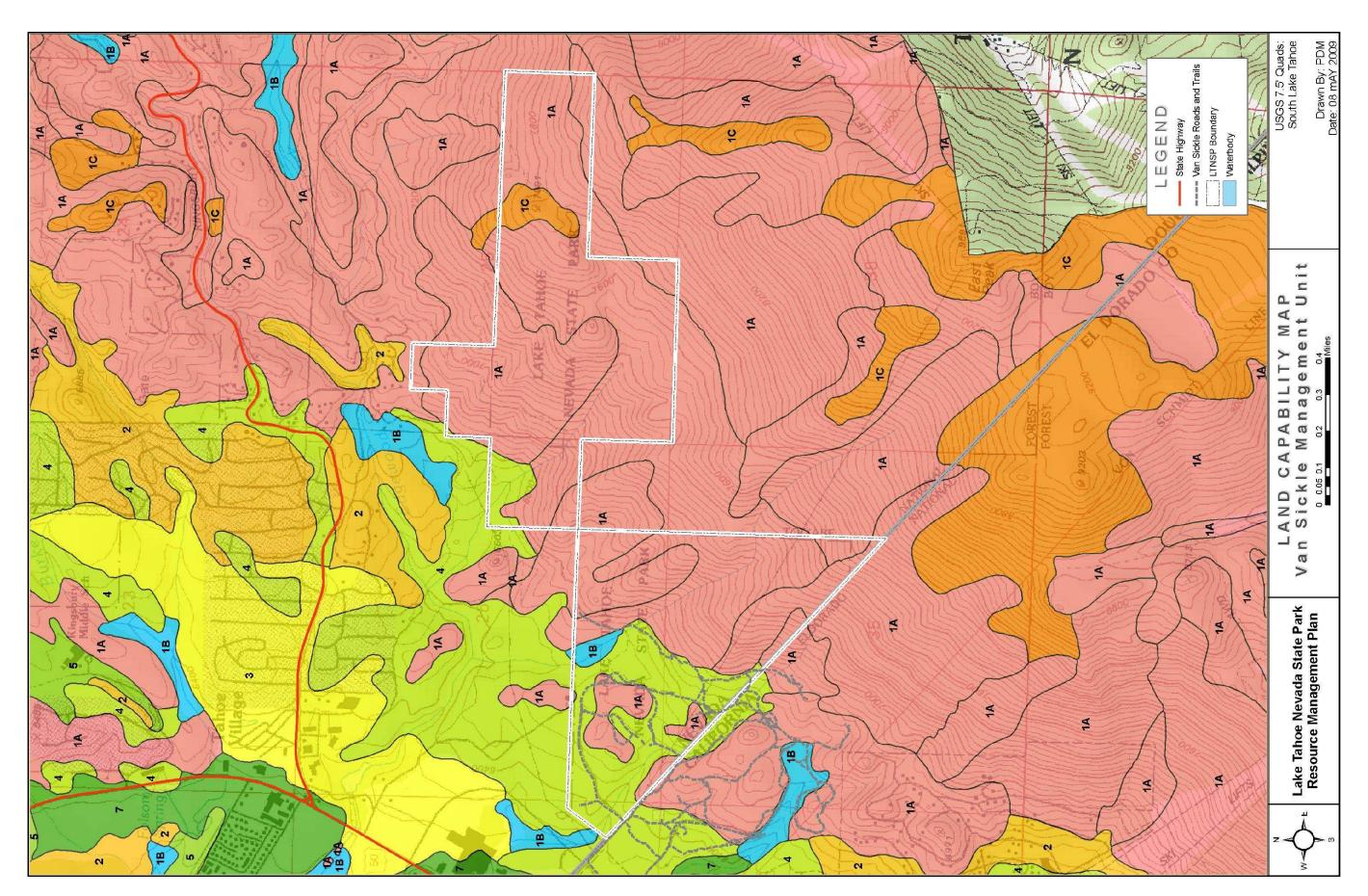


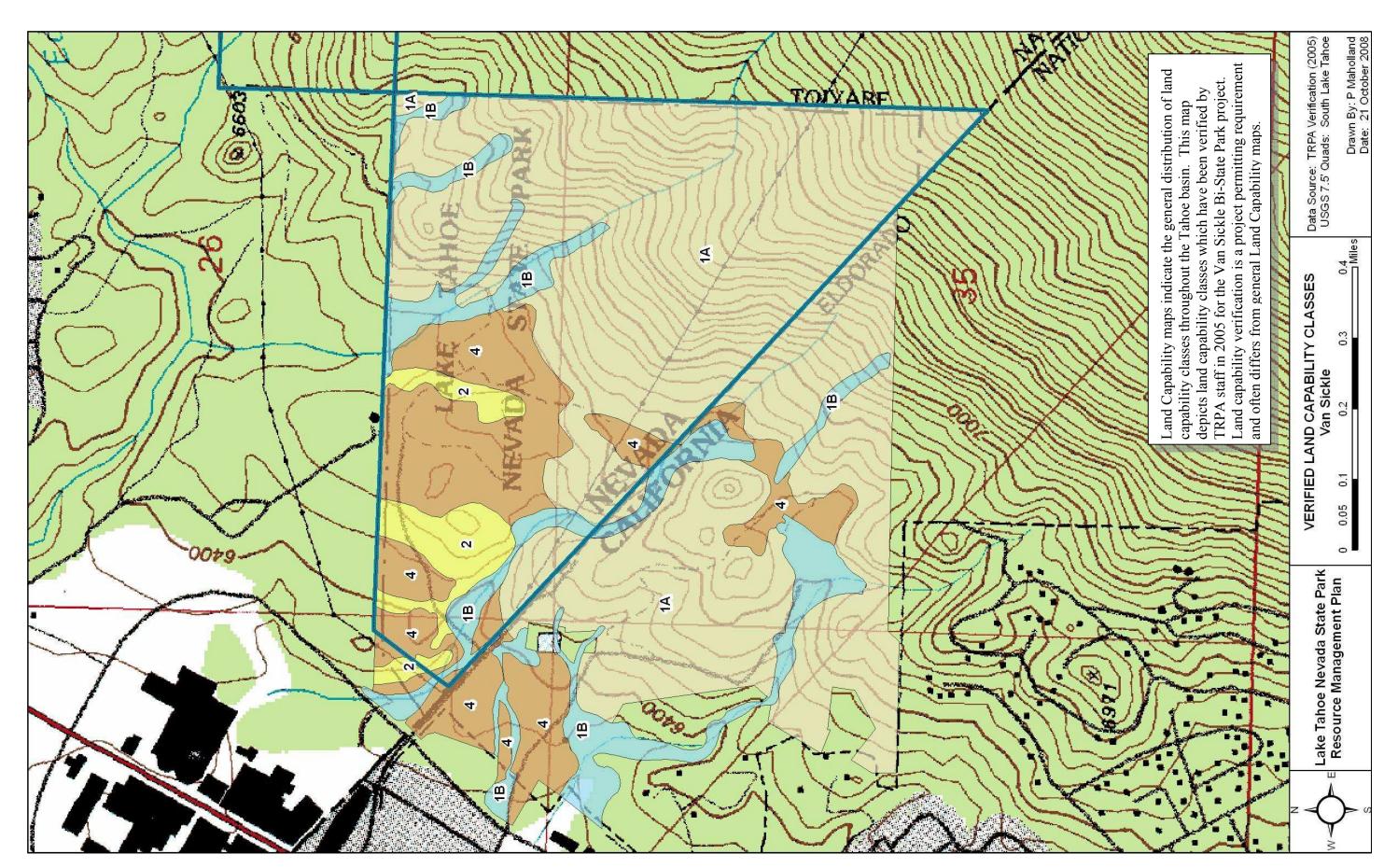


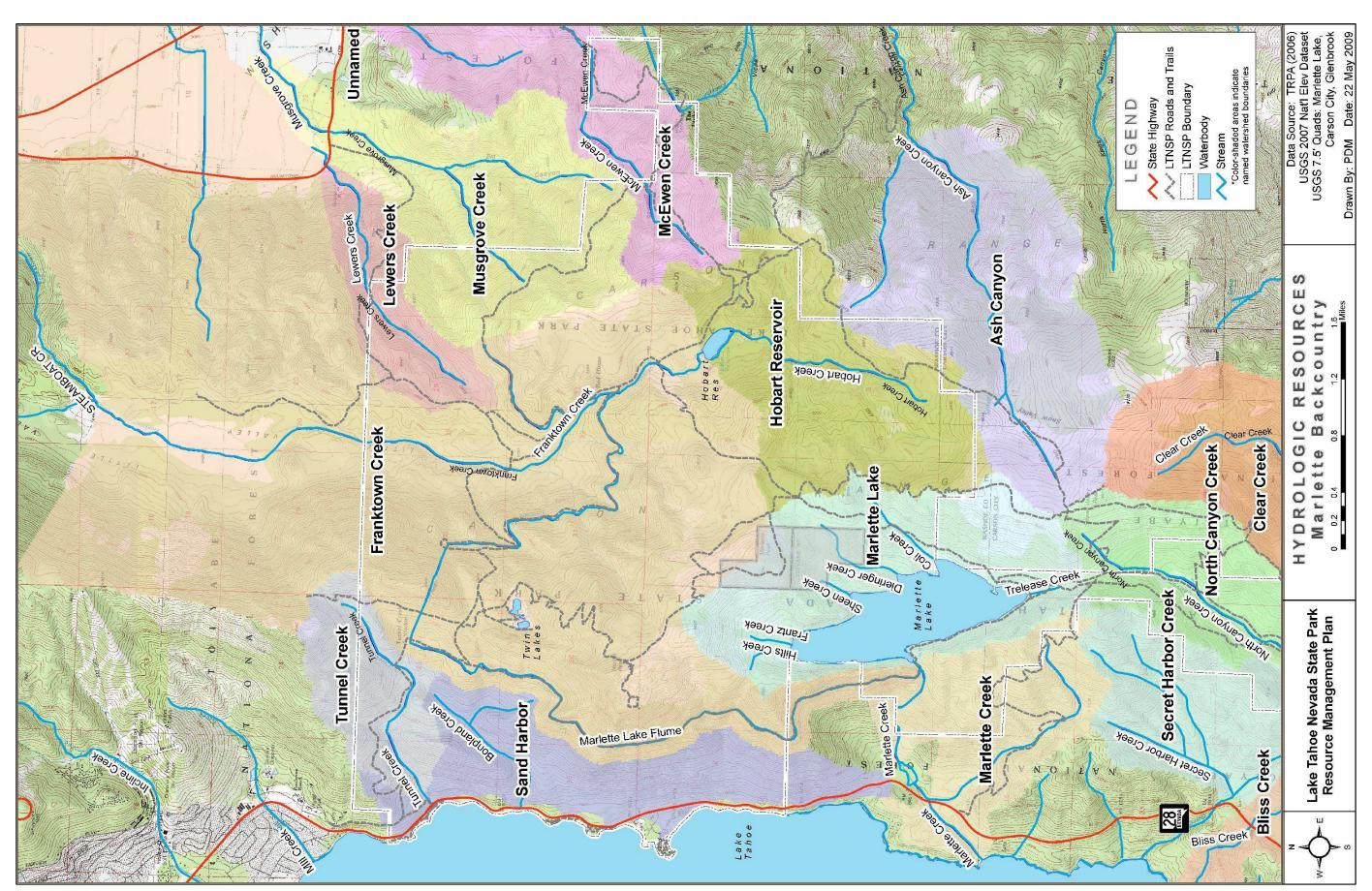


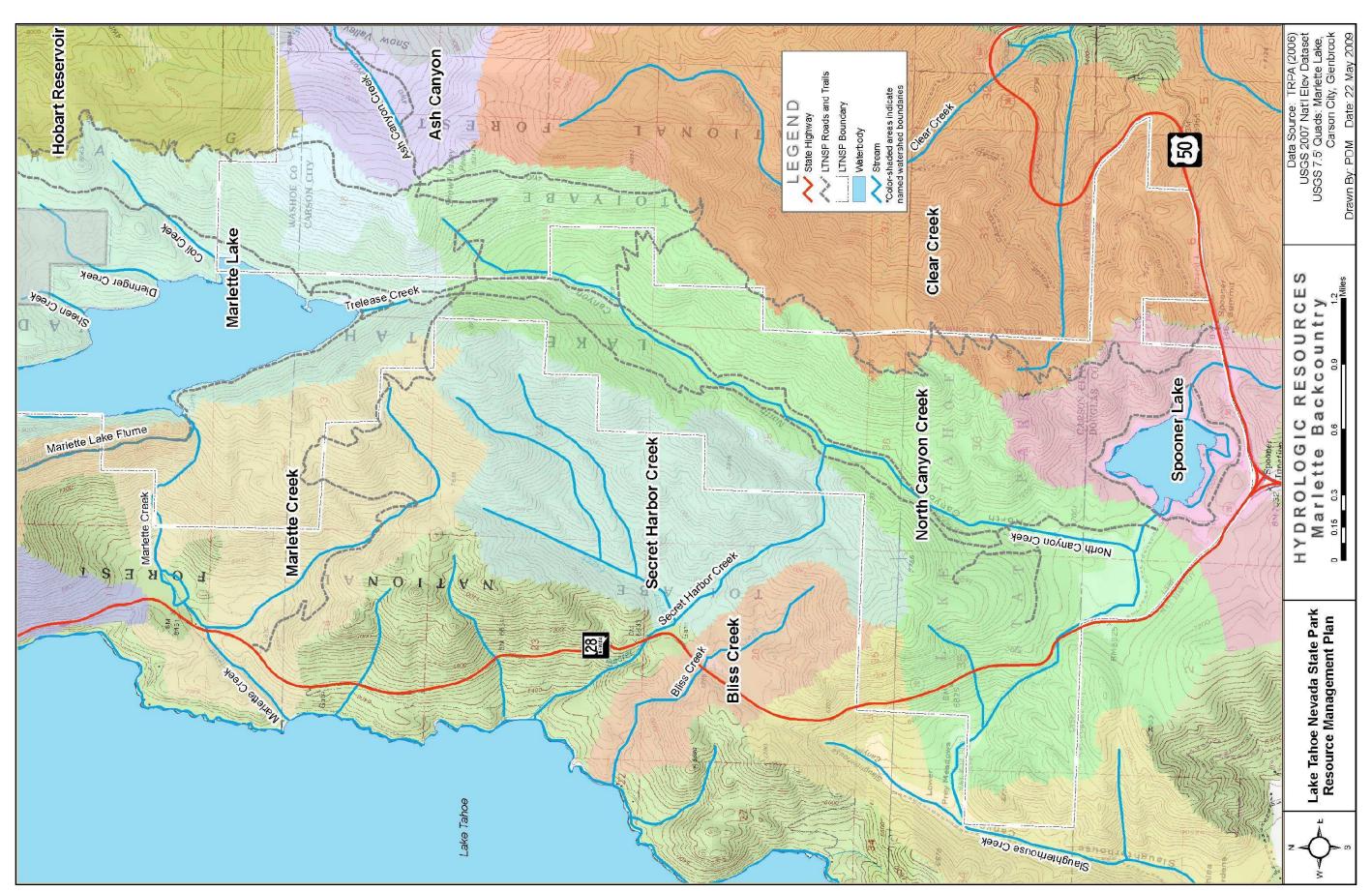




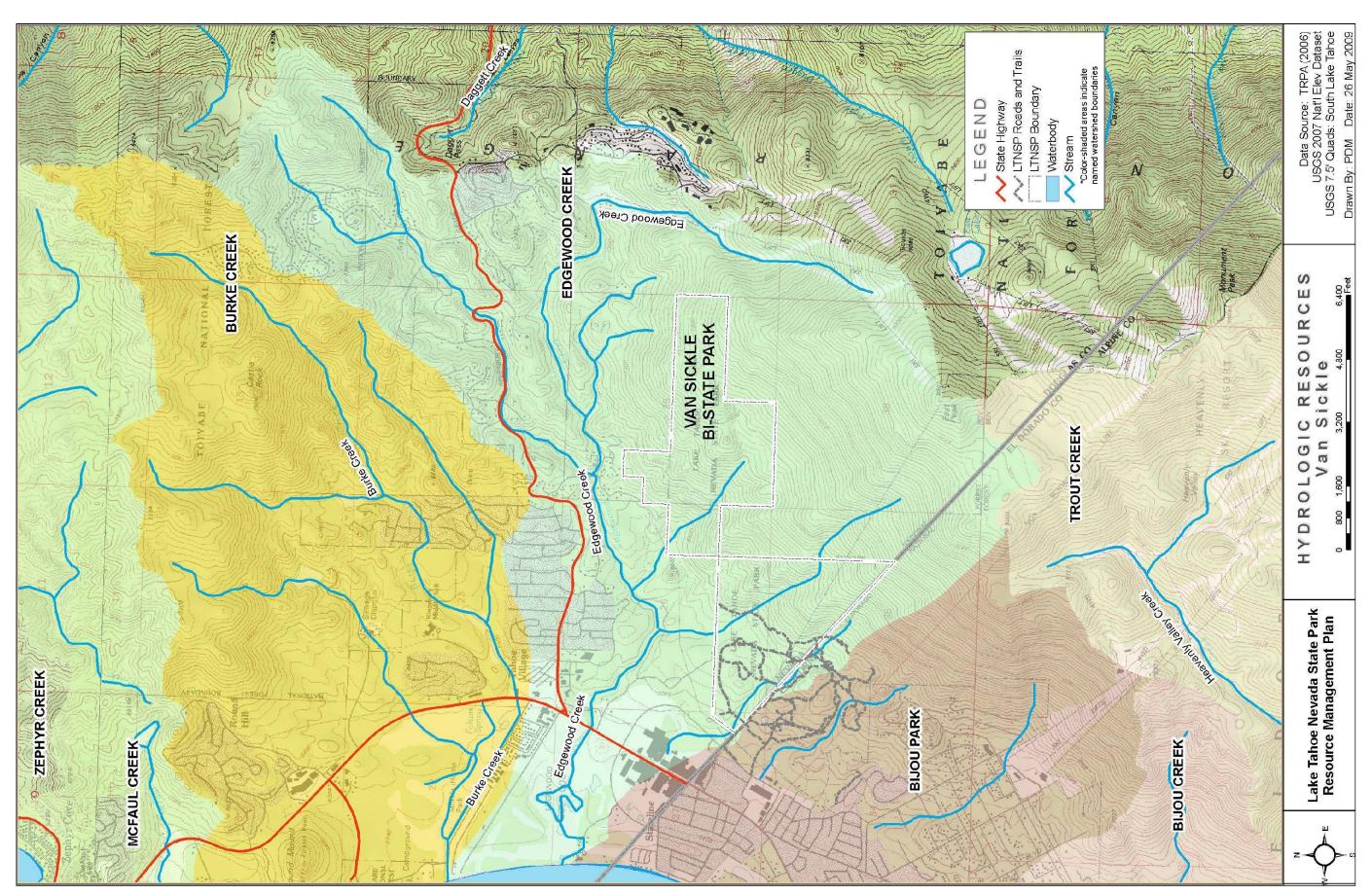


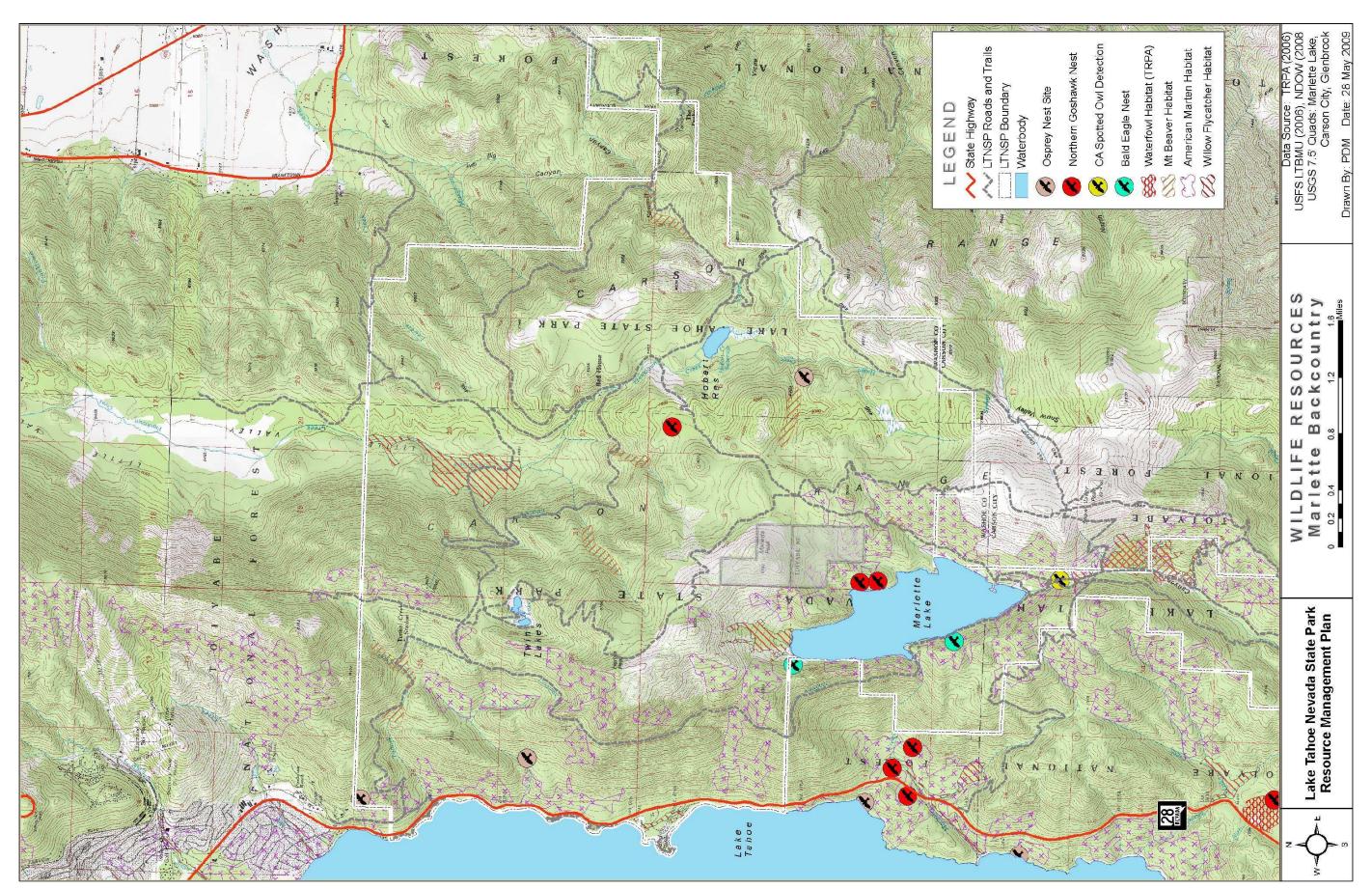


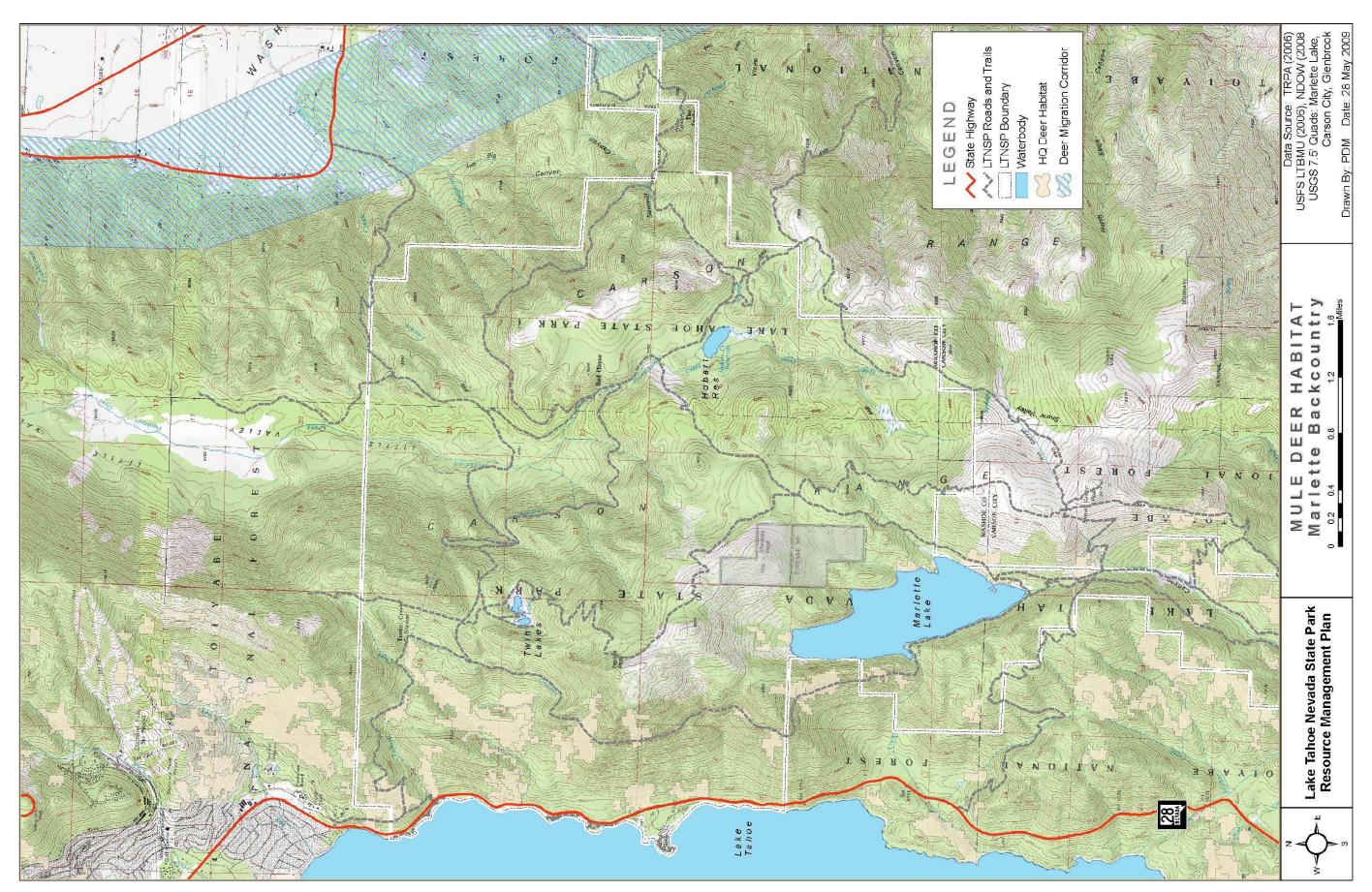


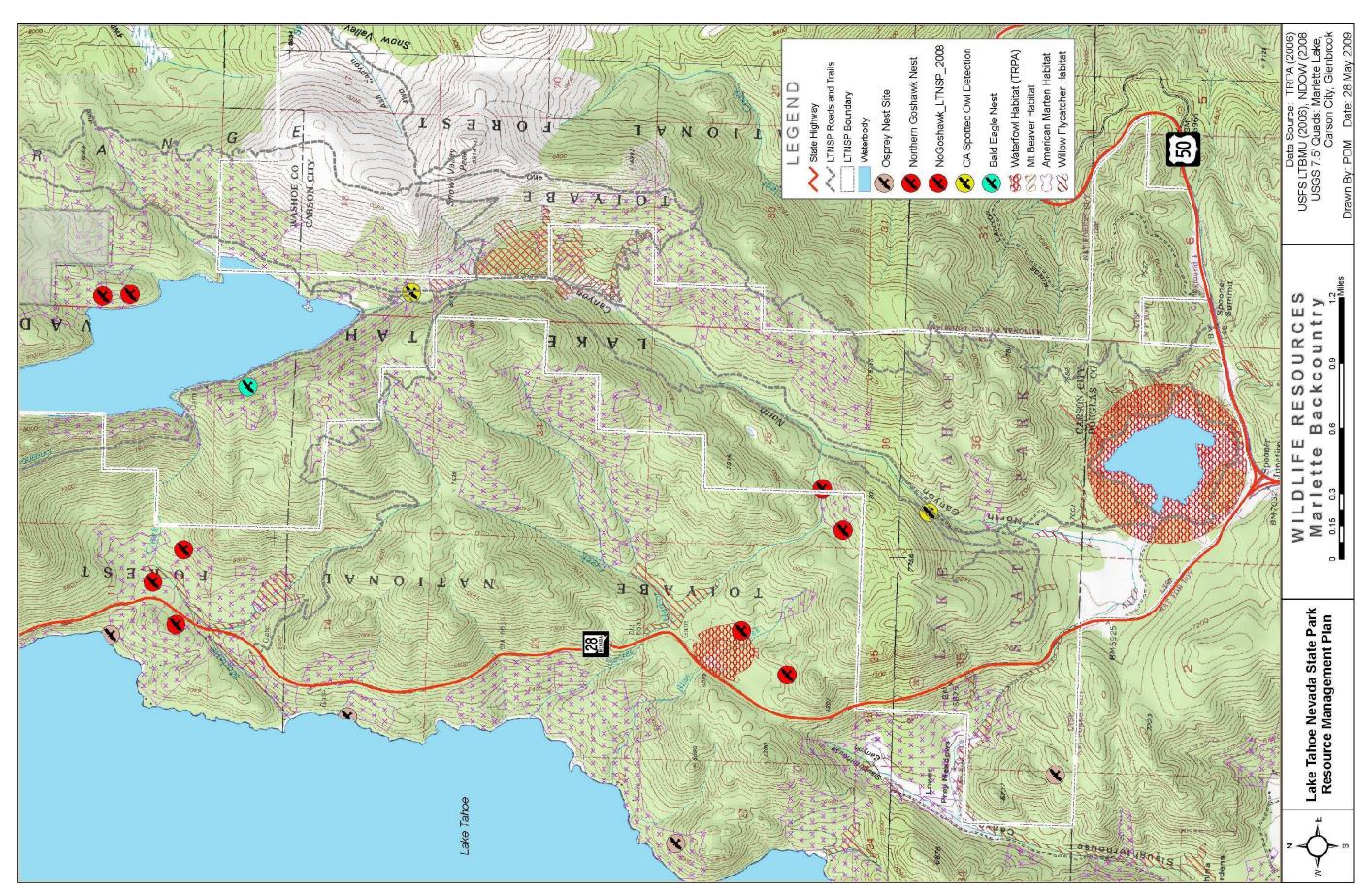




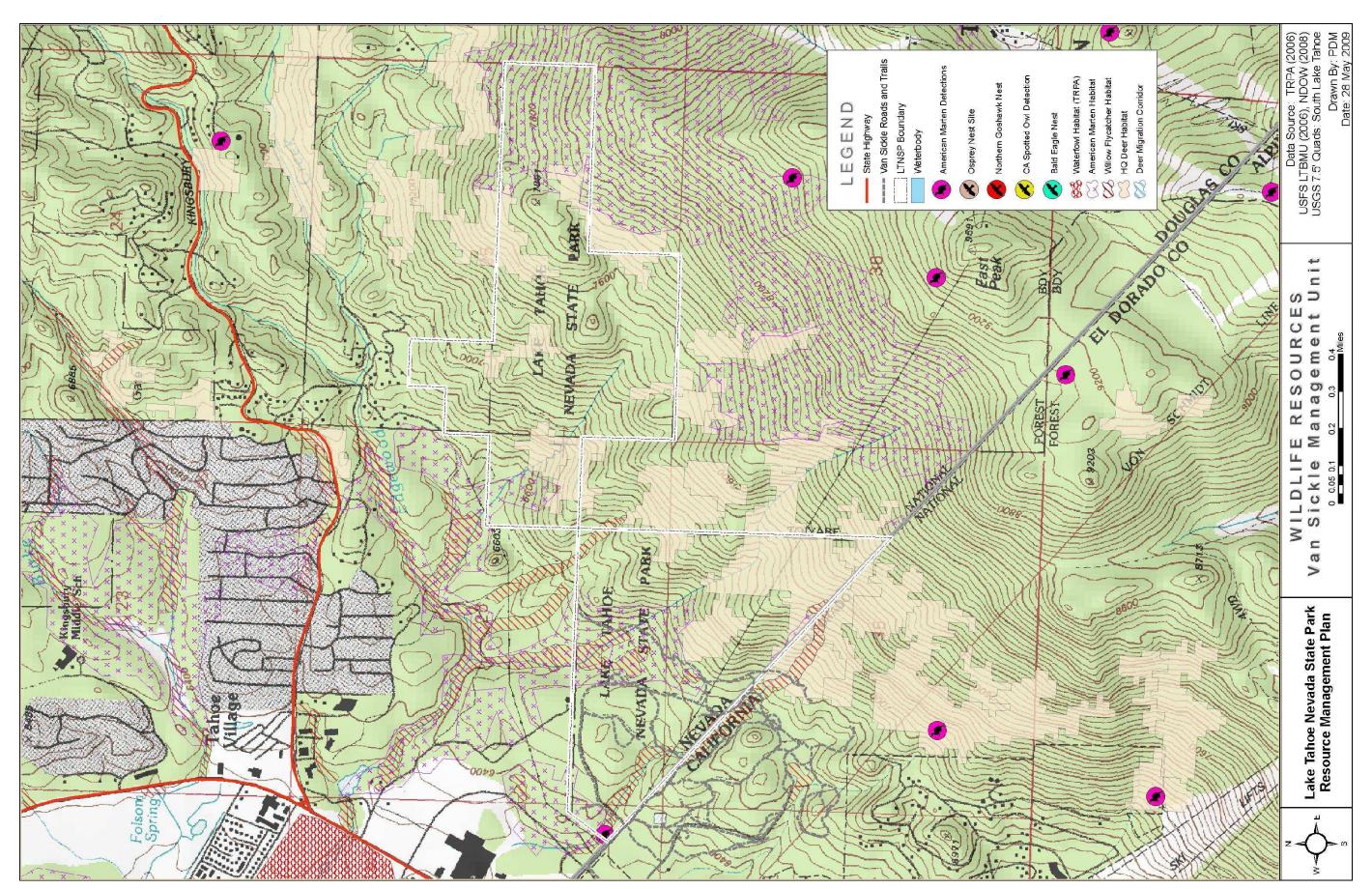


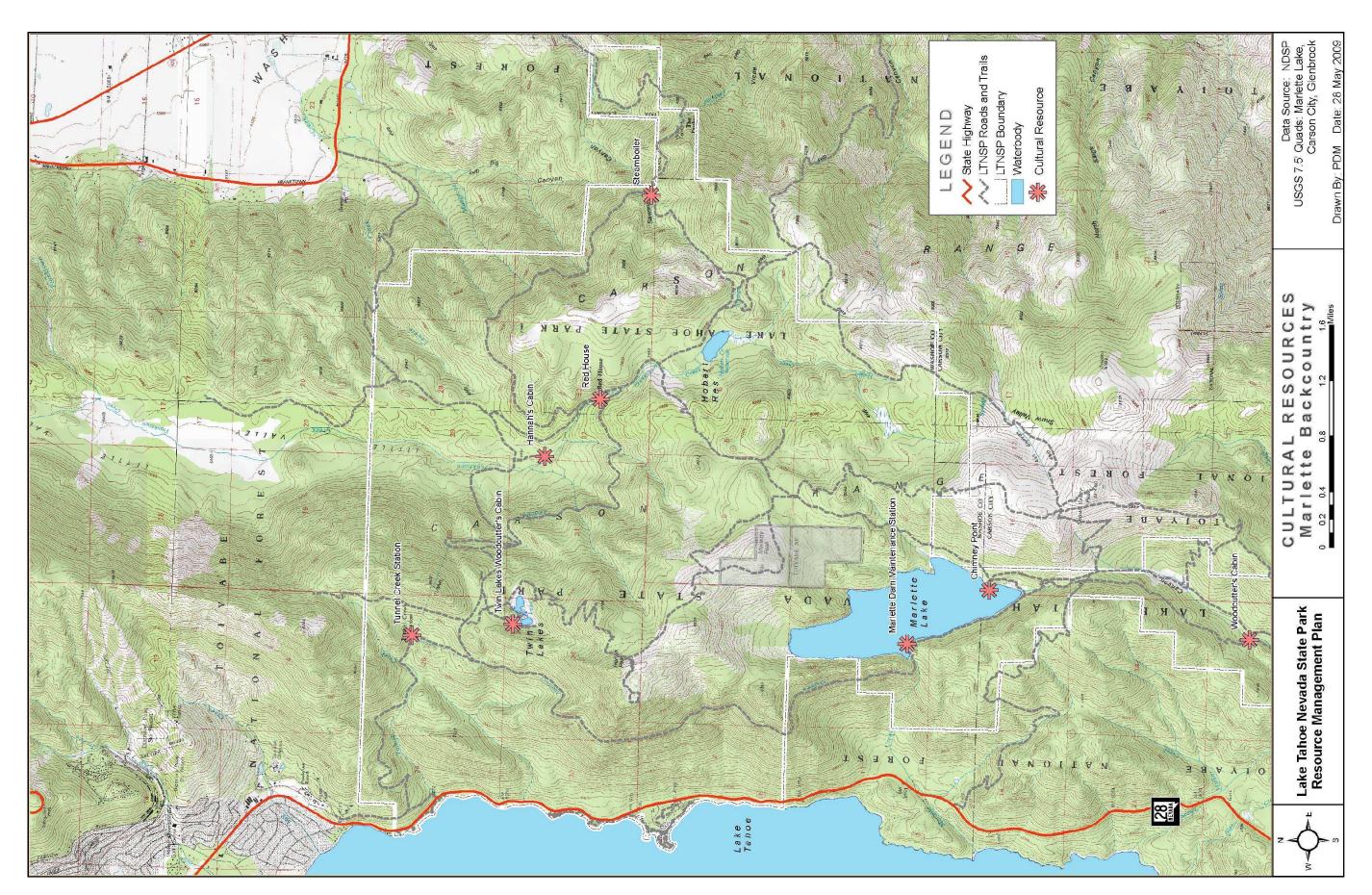




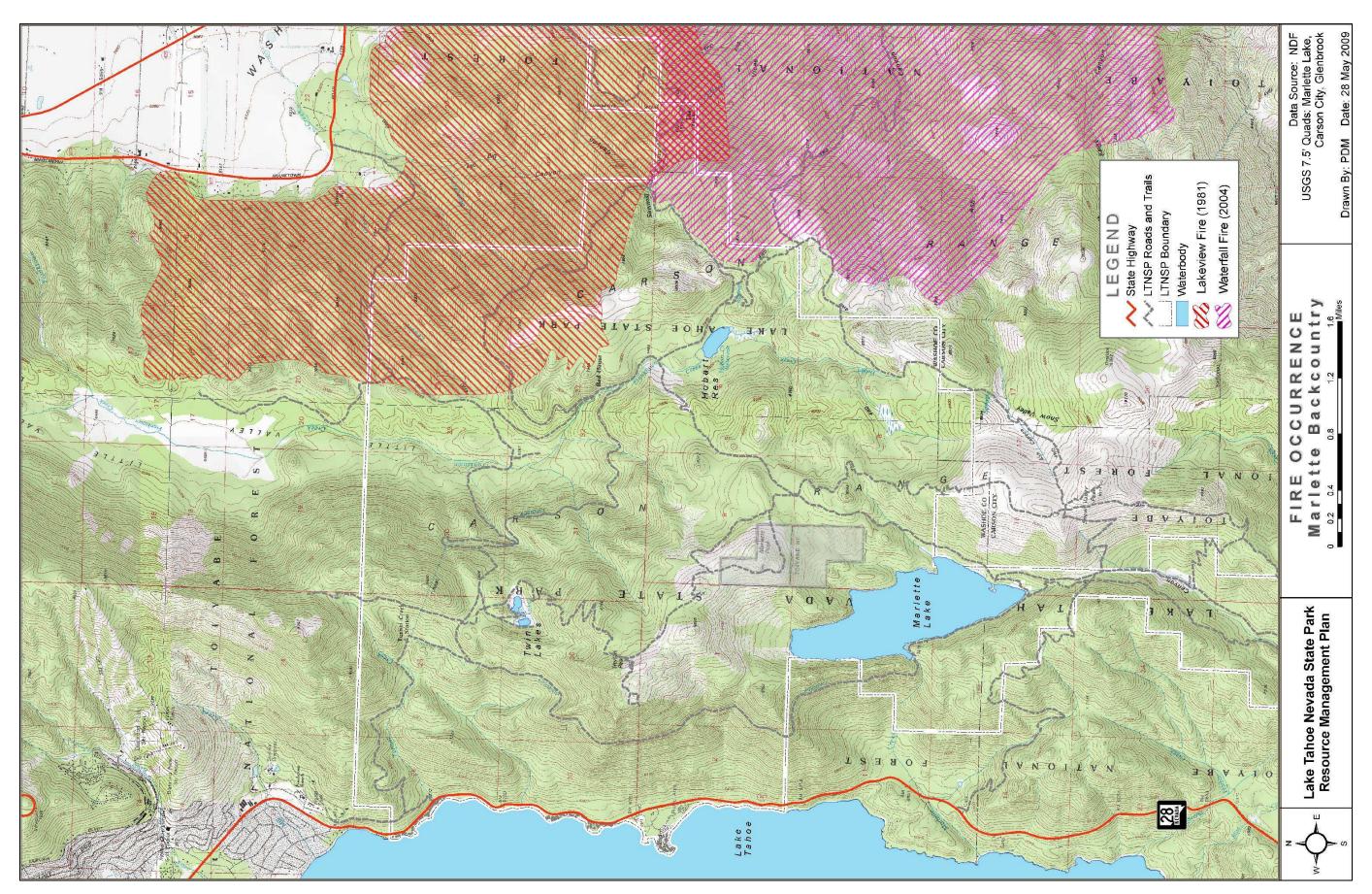


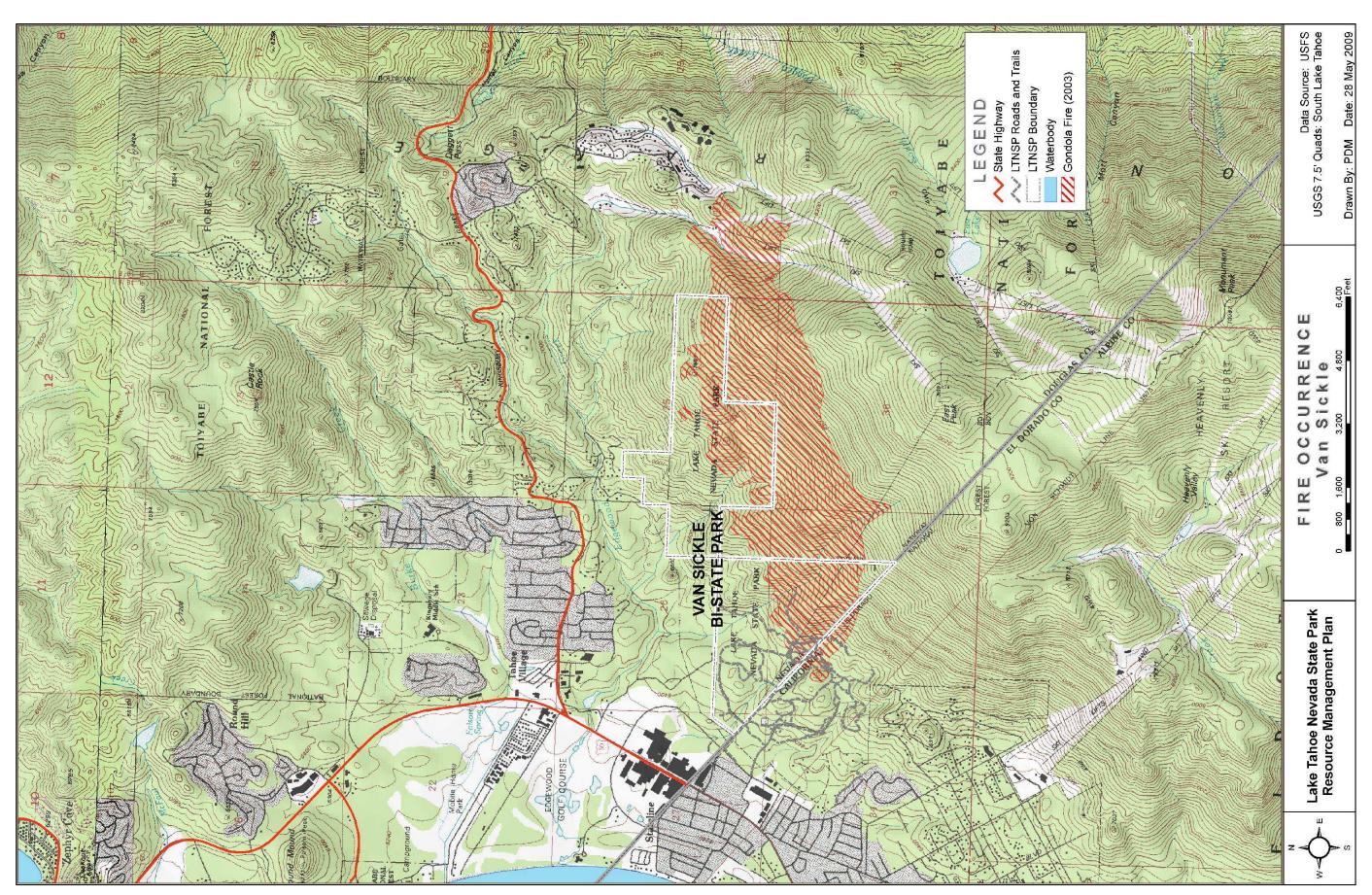


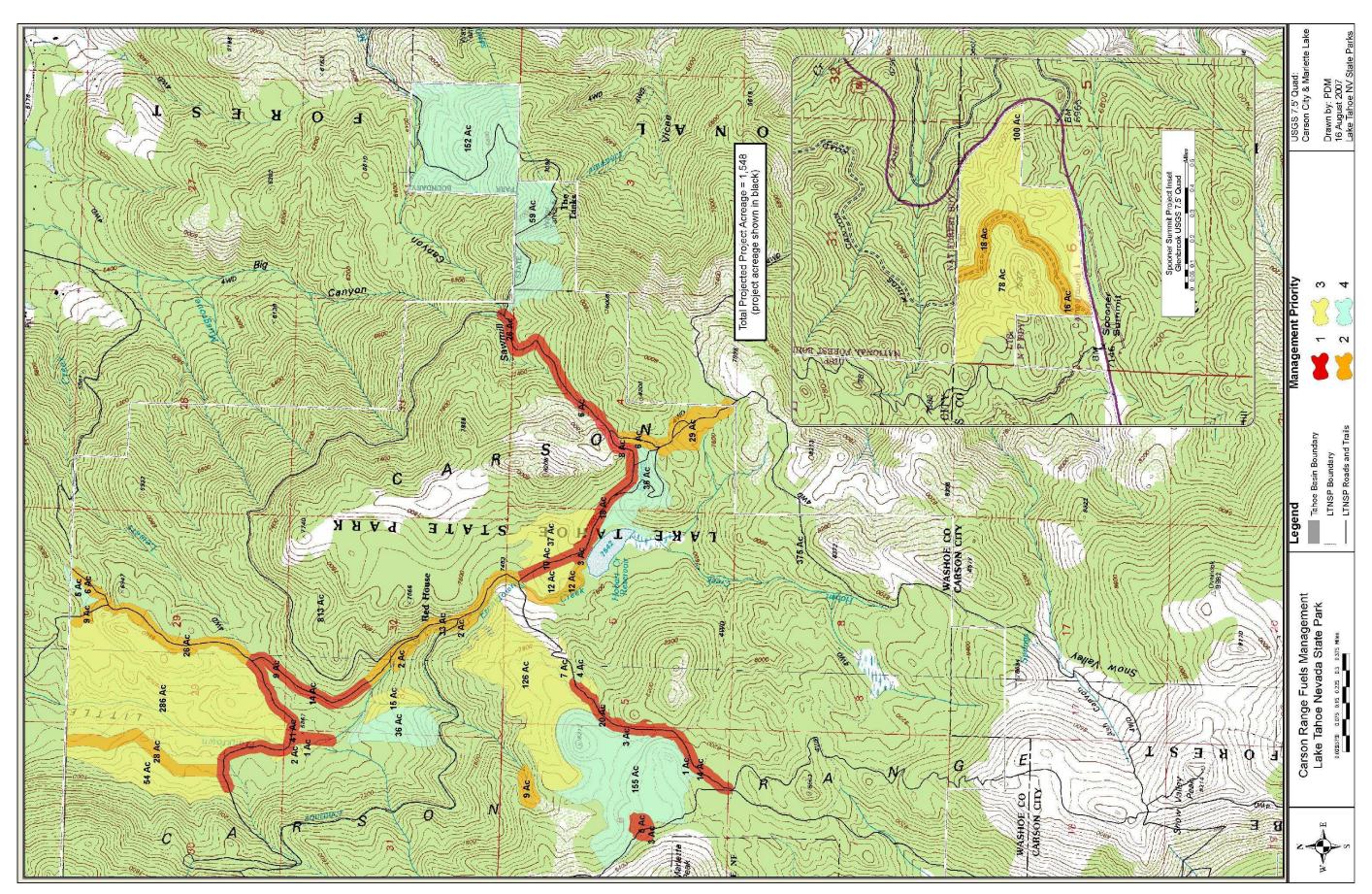


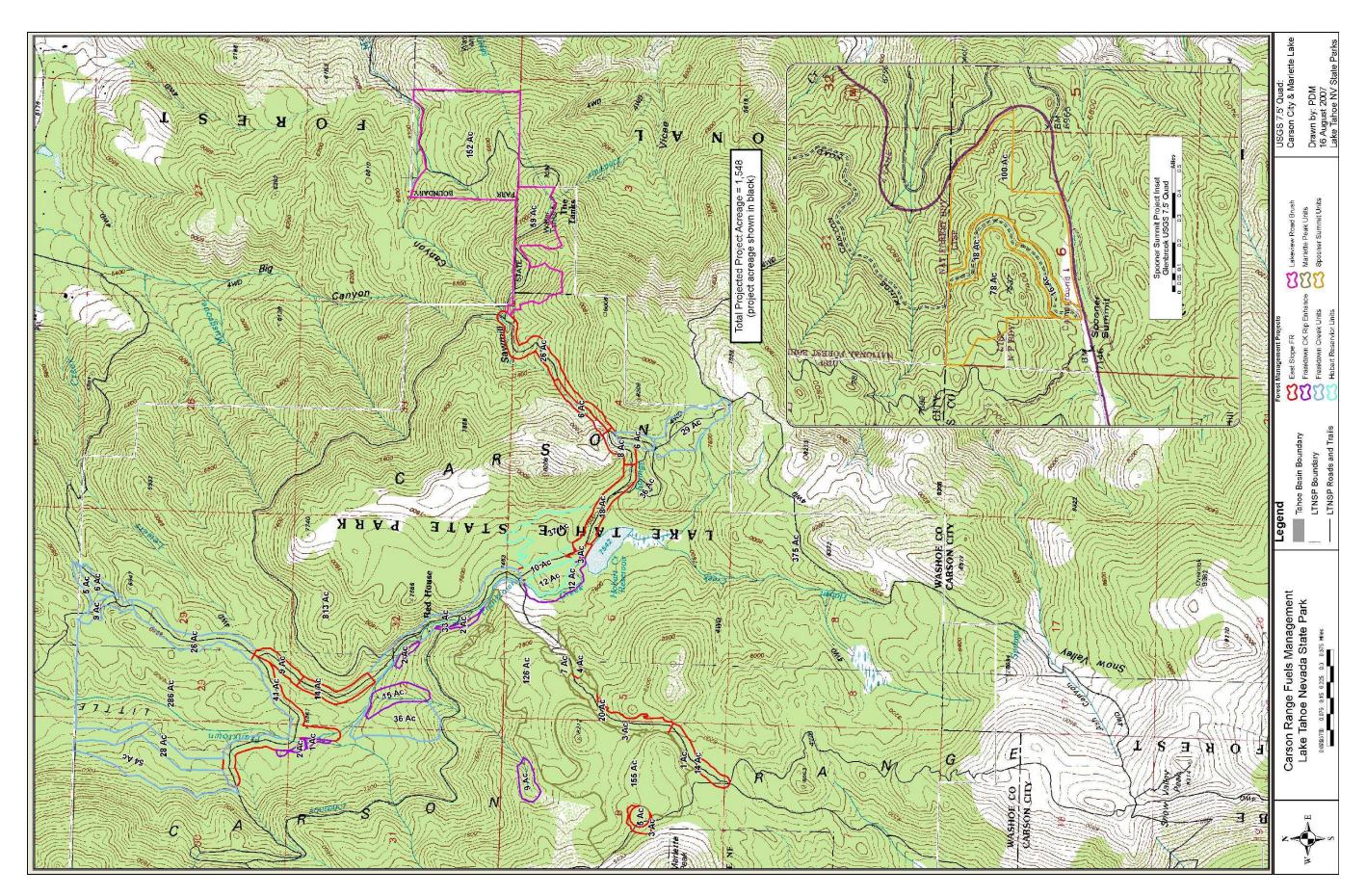


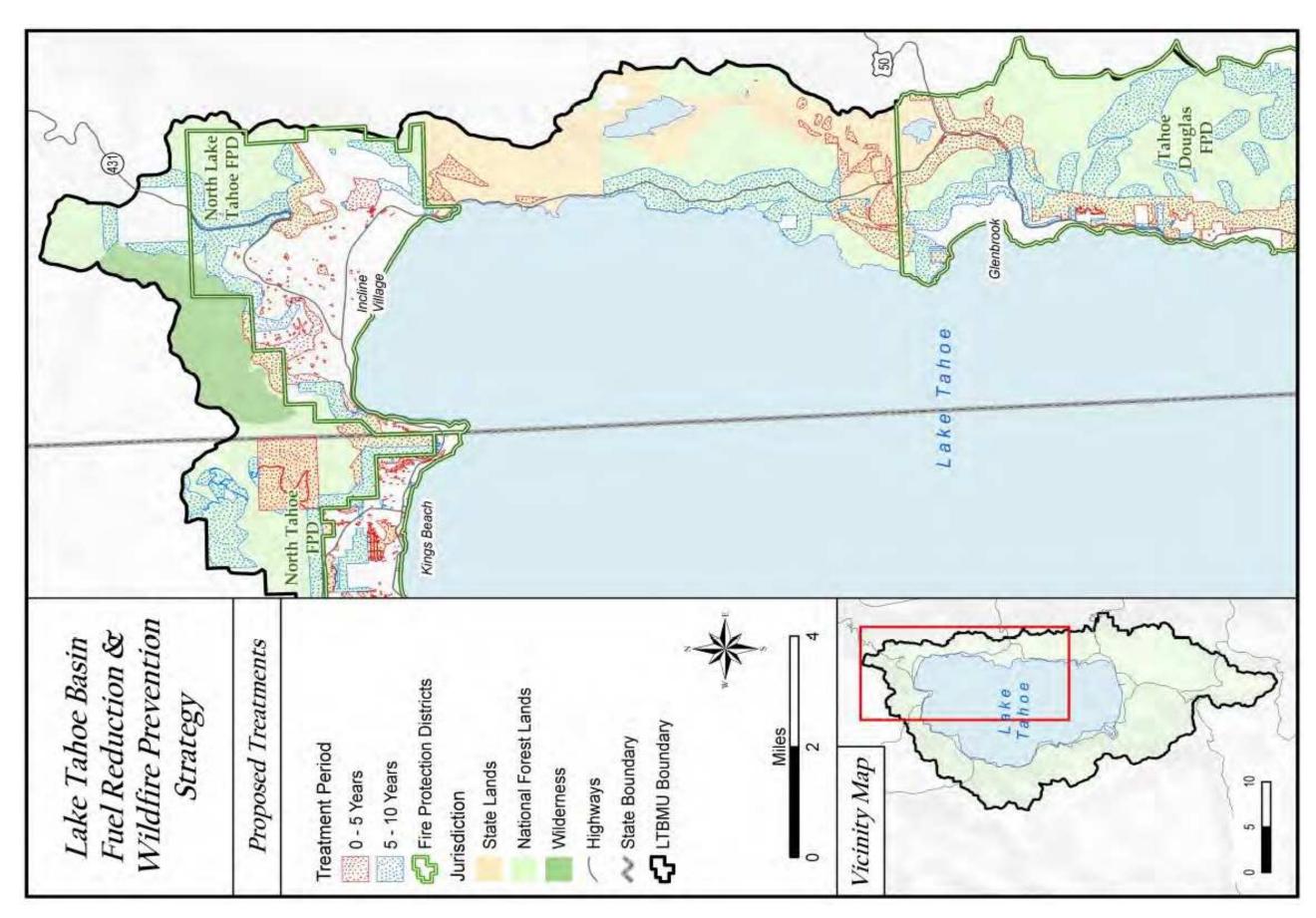


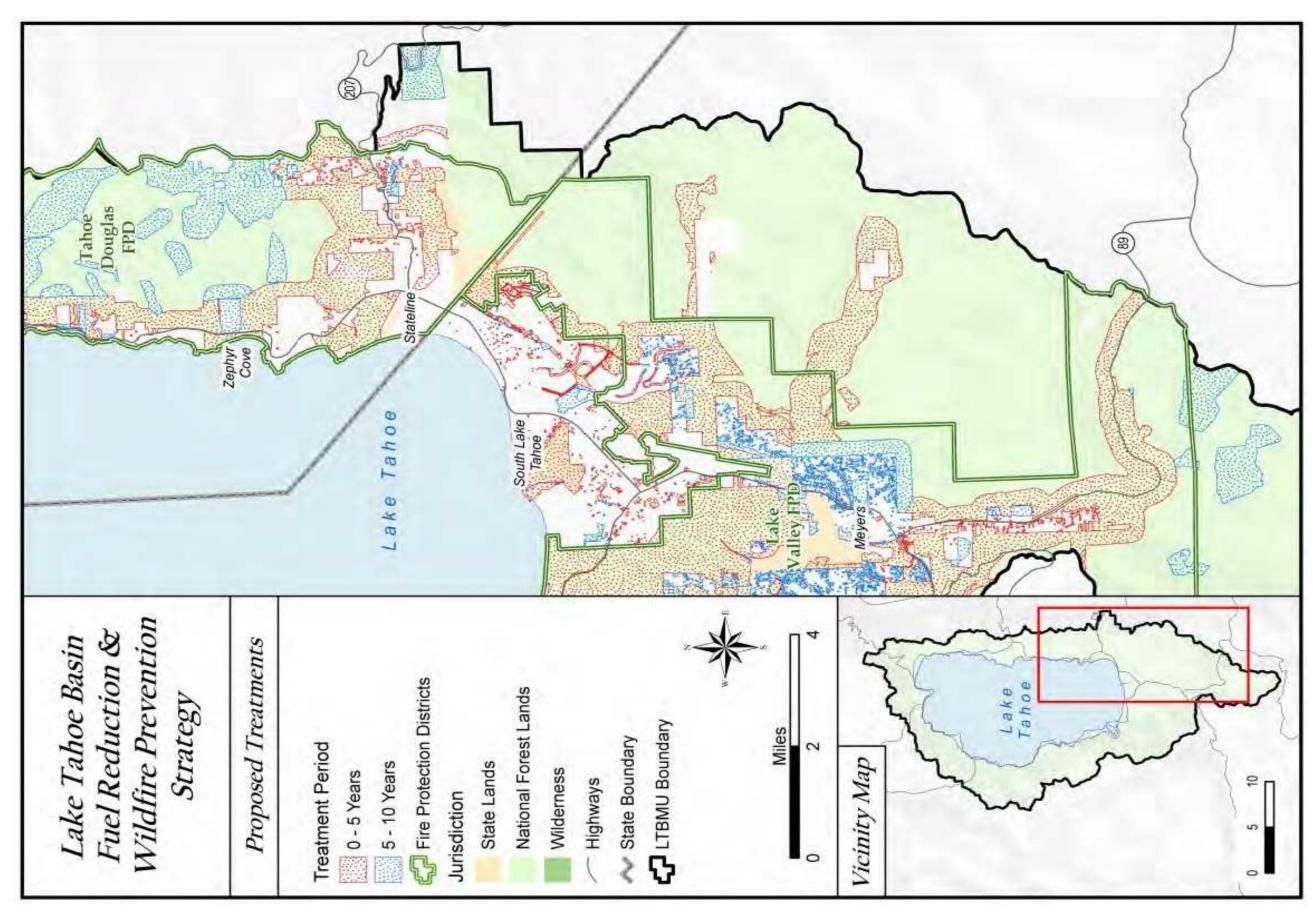












Appendix K – East Slope Forest and Fuels Management Plan







EAST SLOPE FOREST AND FUELS MANAGEMENT PLAN Lake Tahoe Nevada State Park

Nevada Division of State Parks Nevada Division of Forestry

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Purpose and Need

Forest habitats of the Carson Range have been significantly impacted by human activity since European discovery in 1844, including logging activities related to Comstock mining operations and the elimination of fire over the past hundred years in response to a nation-wide policy of aggressive fire suppression. As a result, today's forests are less structurally diverse, support fewer wildlife species, and are more prone to experience catastrophic wildfire and outbreaks of insects and disease. Fire suppression techniques, repeated drought cycles, insect infestation, and diseases have combined in the east slope of the Park to result in a thick forest with significant ladder fuels (lower branches on trees) and both dead and down and standing dead plant material. Due to the condition of this forest, it has the potential to carry intensely hot and devastating wildfires. The entire Park and the surrounding areas are susceptible to these wildfires.

This plan was developed as part of a collaborative effort between the Nevada Division of Forestry and Nevada State Parks and is consistent with a multi-agency effort to strategically manage fuels along the entire eastern front of the Carson Range (see figure 1) and forest management work being implemented in the Lake Tahoe Basin under the Environmental Improvement Program (EIP). This plan synthesizes existing information, data, and reports relating to Lake Tahoe Nevada State Park and provides management direction for fuels reduction and wildfire mitigation projects within the Park. Specifically, the plan outlines the priority areas needing treatment, treatment methods, and existing and future funding options to complete work.

A recent amendment to the Southern Nevada Public Lands Management Act (SNPLMA) makes SNPLMA funding available for fuels reduction work along the Carson Range. In order to access this funding, the USDA Forest Service is leading an effort to develop two "Comprehensive, Cost Effective, Multi-jurisdictional Hazardous Fuels Reduction and Wildfire Prevention Plans" for Lake Tahoe and the Carson Range. A number of entities have been involved in the planning process, including staff representing local fire districts; Reno and Carson City; Douglas and Washoe County; NDF and NDSP; University of Nevada, Reno; Washoe Tribe; US Forest Service; and the Nevada Fire Safe Council. It is anticipated that the strategic plan will be completed in November 2007.

Resources at Risk

The 13,631-acre Lake Tahoe Nevada State Park is a popular recreational and scenic unit with miles of roads and trail that provide hikers, bikers and equestrian users with a significant outdoor experience. It contains many structures, utilities, and resources that could be at immediate risk if a fire started in or migrated through the Park. In addition, surrounding areas would also be at risk of a fire starting within or carrying through the east slope area of the Park. The Park is adjacent to the communities of Incline Village to the northwest, the Lakeview subdivision to the east, as well as the urban areas of Carson City and the community of Franktown. A 120-kilovolt power transmission line traverses the Park for approximately 4.62 miles, running through part of the Park's backcountry unit. The power transmission line supplies power to communities on the north side of Lake Tahoe. The Park also contains the Marlette Lake Water System, a National Register Historic District, which currently supplies water to Virginia City, Silver City, Gold Hill, and Carson City. Additionally, the Park contains a gas line serving communities in Lake Tahoe (Pauite Pipleline), significant wildlife habitats (including remnant old growth forest stands and

riparian corridors), many prehistoric cultural resources and historic cultural resources from the Comstock era. Therefore, action is needed to reduce wildfire risks within the east slope of the Park.

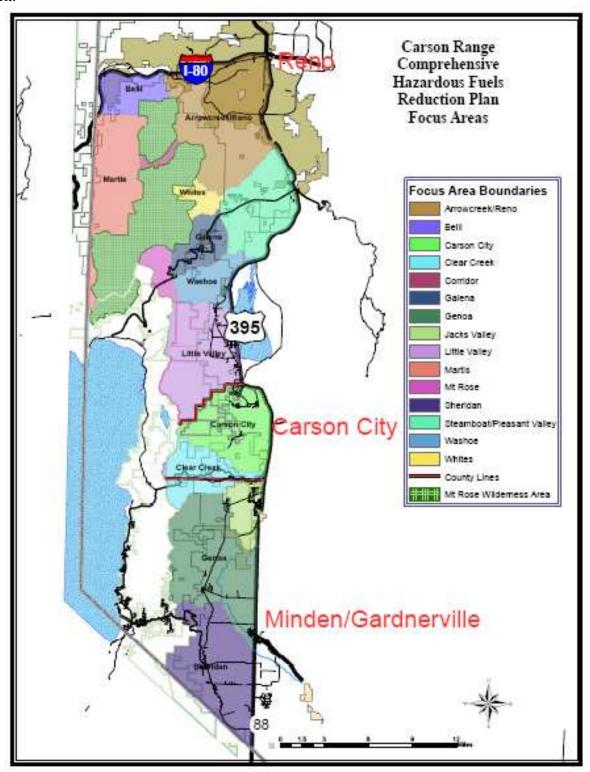


Figure 1. Carson Range comprehensive fuels reduction plan focus areas. State Parks ownership is located within the Clear Creek and Little Valley Focus Areas.

Lake Tahoe Fireshed Assessment

SB 226 directs staff to evaluate the Stewardship & Fireshed Assessment relative to protecting the Lake Tahoe Basin from wildfire from outside of the Basin. The Stewardship & Fireshed Assessment (SFA) is a process for developing fuels reduction projects consistent with the goals of the Healthy Forests Restoration Act, National Fire Plan, and national forest land and resource management plans.

NDF staff have reviewed the Lake Tahoe Basin SFA and discussed the likelihood of fires burning westward into the Basin with USFS staff at the Carson Ranger District and determined this is a highly unlikely scenario, based on several factors:

- All of the major fires that have occurred in recent history along the eastern portion of the Carson Range have burned south to north and not westerly;
- Predominant winds, which drives fire growth and direction, flow from the west and south west along the Carson Range, and;
- At higher elevations along the basin boundary, vegetation composition, tree spacing, and moisture are not likely to support significant fire spread and therefore provide some buffer between the east and west slopes.

Although implementation of fuels reduction projects on the east slope would only moderately reduce the threat of wildfire to the Lake Tahoe Basin, these projects would significantly reduce the threat for Carson City and vicinity. Further, proposed fuels treatments will complement work being completed in the Basin by the State of Nevada as part of the Environmental Improvement Program and work being planned by a number of entities through the coordinated Carson Range Comprehensive Fuels Strategy.

Priority Treatment Areas

Priority treatment areas for fuels management were developed by an interagency team through a review of previous forest health and fuels management reports for the Park, values at risk, on the ground field evaluations, and GIS analysis of existing vegetation, cover, slope, and other fire behavior parameters. This latter analysis utilized a recently completed vegetation map that was derived from high resolution satellite imagery specifically for the Park and was funded through a grant from FEMA's Hazard Mitigation Grant Program and Park's User Fee Overages.

Attached Map 1 shows the priority treatment areas for the east side of the Park (outside of the Lake Tahoe Basin). Priority is shown in order from 1 to 4, with 1 being the highest priority treatment area. It is important to note that projects with priority designations of 2-4 may be implemented out of order based upon opportunities and funding availability. Attached Map 2 outlines the project areas by name and acreage.

Priority 1 treatment areas consist of fuel breaks in areas of heavy fuel loading within 150 feet of Hobart Road, around two significant historic structures (Red Cabin and Hannah's Cabin), and adjacent to two campgrounds. These areas are considered to be the most likely areas for fires to start, and are therefore designed to both reduce the potential for ignitions and to cause crown

fires to return to surface fires as they move through. Vegetation in these areas is primarily classified as Sierran mixed conifer and lodgepole pine, some of which is located on steep slopes.

Priority 2 areas include continued fuel breaks portions of Hobart Road that will create a continuous and defensible fuel break in the Park when joined up with completed Priority 1 projects. Also included is a fuel break along the road linking the parking area at the top of Ash Canyon Road to Hobart Road, a 150-foot fuel break along the Park-owned portion of Kings Canyon Road near Spooner Summit, and Nevada Department of Wildlife (NDOW) Riparian Enhancement projects.

Priority 3 areas consist mostly of larger forested areas with heavy fuel loading in mixed Sierran conifer forest that have the potential to be difficult to control should a fire move through these areas. These areas are less easily accessed, but provide the opportunity for commercial operations and will enhance the effectiveness of higher priority fuel breaks. Priority 4 areas are similar to Priority 3 treatment areas, but are a lower priority for implementation due to considerations such as access issues or location.

General Forest Management Prescription

The following provides a general overview of the type of prescription that will be implemented in fuels reduction projects. This prescription may be modified depending upon site conditions, opportunity, resource values (such as sensitive species), input from other resource specialists, and potential for ignition.

Treatment areas would be thinned to an approximate basal area range of 80 to 120 square feet per acre, depending upon site conditions and threat. Trees identified as being hazardous to public safety (hazard trees) would be removed. Within fuel breaks, all standing dead trees would be cut. Outside of fuel breaks, three to five of the largest standing dead trees per acre would be retained, where available. Live trees with a 24-inch diameter breast height (dbh) size or greater would be left to add to the forest old growth component, unless they are considered a hazard. Pine species and incense cedar would be given priority as leave trees, with the resultant stand representing an uneven-aged forest, to the extent practical.

Ladder fuels would be removed as high as is safely possible by work crews, but no greater than one-fourth of the tree canopy would be removed. All dead and decadent shrubs (shrubs with less than 50 percent foliar cover), all shrubs growing directly beneath the drip line of leave trees, and a minimum of 50 percent of the remaining live brush would be removed to reduce horizontal fuel continuity. Occasional downed logs would be left in treatment areas and preferentially located parallel to slope contours to slow and disperse water runoff throughout the area. Downed decaying logs would be reserved for wildlife, erosion control, and nutrient cycling.

In aspen and other riparian areas, overstory removal methods may be employed to address both conifer encroachment and fuels reduction objectives. Over story removal treatment areas would cut and remove most conifers in a given area, and would be conducted in consultation with representatives from the Nevada Department of Wildlife (NDOW) and Nevada Division of Environmental Protection to ensure all appropriate resource protection measures are incorporated into the project. Overall project planning and implementation will be coordinated and approved

by (as appropriate) staff from the State Historic Preservation Office (SHPO), NDOW, and the Nevada Natural Heritage Program (NNHP) to ensure appropriate mitigation measures are in place to protect archeological, cultural, plant, and wildlife resources.

Implementation

A variety of methods will be used to achieve the plan's fuels reduction objectives. Primary among these will be the use of hand crews, due primarily to issues currently related to access, commercial operator availability and interest, and site conditions. These methods are outlined below, as are additional implementation considerations. Project areas where methods other than hand crews can be employed are indicated in the appropriate descriptions.

Hand Crews

As mentioned above, hand crews will likely constitute the majority of treatments within the Park. These crews include NDF conservation camp crews, crews from the Nevada Conservation Corps, and privately contracted crews through the Good of the State fuels reduction services contract. Hand crews may complete all aspects of a project area or part of other operations. When feasible, wood products generated by hand crews will be sold as fuelwood by Parks staff to be used to assist with funding of future forest management work.

Commercial logging

Other than equipment limitations related to soils and slope, access is the critical driving force in effectively implementing commercial timber sales within the Park. In order to accommodate equipment and logging trucks to remove merchantable material, the existing road infrastructure would need to be upgraded significantly, requiring an equally significant funding investment. An analysis of the road infrastructure relative to supporting commercial timber removal is provided further in this document.

Despite access issues, several commercial timber harvesting operations are envisioned primarily in the northern portion of the Park. These project areas would utilize Musgrove Canyon Road, which could be upgraded with minimal investment. The project areas are located on more gentle slopes, lending themselves to the use of equipment, and have been previously identified as areas of significant insect and disease mortality. Smaller scale commercial activities could take place in the vicinity of Sunflower Hill, below Laxalt Junction, and the Spooner Summit area, utilizing extraction options such as cut-to-length (CTL) equipment and truck mounted tower cable yarding.

Christmas Tree Sales

Christmas tree sales provide the opportunity to remove small diameter trees for no-cost and potentially generate small amounts of revenue through the sale of permits by making the trees available to individual members of the public. This approach may be used in the future; however, it is not anticipated that Christmas tree sales will be used in any of the project areas outlined in this plan due to the relatively poor access for private vehicles, the types and sizes of

trees requiring removal, and the significant staff time that would be needed to properly administer the sales.

Individual Wood Permits

The issuance of individual permits for the felling and removal of designated trees within a project area could be utilized to reduce treatment costs, though they are generally considered to be more of an outreach to the public versus a cost-effective means to accomplish project objectives. Individual wood permits, like Christmas tree permits, require a high level of administrative oversight to issue permits, ensure individuals take only designated trees and do not create significant hazards and obstacles, and that operations proceed in a safe manner. Additionally, access to many of the high priority project areas is limited to 4WD vehicles. Removal through the use of individual wood permits is not envisioned at this time, but may be used as projects develop if appropriate opportunities arise. However, annual wood sale permits and sales as currently administered by Parks staff are still envisioned.

Biomass Utilization

Large amounts of forest biomass will be generated from the fuels reduction efforts in the park, which includes both merchantable and unmerchantable saw logs, fuel wood, and slash (limbs and brush). A significant portion of the biomass harvested will have to be burned on site due to difficulty in moving the material to adjacent roads. All burning activities will be conducted under a prescribed fire plan that would be developed, approved and conducted by the Nevada Division of Forestry. A proportion of harvested biomass will be chipped and broadcast in areas where an inadequate forest floor duff layer exists (less than approximately 4 to 5 inches of duff layer) to assist with erosion control.

Where access allows, slash and logs not being sold as saw logs or fuel wood will be cut into manageable lengths and moved to roadside areas, chipped or loaded whole into dump trucks, vans trailers and/or dumpsters for transport to a Carson City biomass utilization facility. Material which can be accessed and sold as fuel wood will be stacked near roads or moved to staging areas and sold through an annual wood sale by permit.

Forest conditions in the Spooner Summit project area would provide a steady stream of biomass material, which with existing good access would be easy to transport to the Northern Nevada Correctional Center's (NNCC) biomass operation in Carson City. NDF is currently working with local hauling companies to determine an equitable hauling cost to facilitate the transportation of biomass with the Park. Options to reduce treatment costs for this project were also explored during a recent field tour with a representative from the US Forest Service Forest Products Lab and a number of State resource staff. The most feasible option discussed involved the use of a downhill cable yarding system to move material from the slopes to landings for processing.

Brush Treatment

There are a number of areas within the Park that contain large areas of continuous brush fields, representing a significant fire threat. Where brush fields constitute a portion of a larger forest management project, horizontal fuel continuity will be broken up through removal of

approximately 50% of the brush and the material will be chipped or burned as described above. However, where brush fields are the majority of the project, two management options are being explored, mastication and herbicide application. Mastication involves the use of a masticating head mounted on various types of heavy equipment to grind shrubs, trees and other material, thereby altering the arrangement of fuels and reducing fire threat. Costs vary depending on site conditions, but typically range from \$800 to \$1,500 per acre. Herbicides may be applied in a number of ways to suppress the regrowth of cut brush. Within the Park, direct application to stumps is envisioned. Both of these may be used separately or in conjunction with each other in project areas.



Figure 2. Masticating head mounted on track excavator (image courtesy of the UC Berkeley Center for Forestry).

Evaluation of Road Infrastructure

In order to implement commercial forest management projects, an adequate road access system capable of handling the related equipment requirements must be in place. Maximum road grade, minimum curve radius, road width, and soil strength and stability are all considerations in determining whether or not commercial operations are feasible in the Park.

An evaluation of the road system relative to use by commercial logging equipment was completed recently by Parks engineering staff to determine the current condition of the road system, identify any upgrades that may be needed, and provide cost estimates. The evaluation included a field visit, GPS data collection, review of forest road literature and previous road repair evaluations, determination of logging equipment requirements, and previous equipment use in the area. Staff concluded the road system could support commercial logging activity and that existing turn radii and road grades were not limiting, but portions of the road network would require some additional upgrades to the roadbed along Tunnel Creek Road, Lakeview Road, and the Marlette/Hobart Road. Costs associated with these upgrades are outlined in Table 1 and assume drainage facilities will be improved or repaired by Buildings and Grounds during upgrades to the Marlette Water System that are currently underway.

Table 1. Costs associated with upgrading Lake Tahoe NV State Park road network to support commercial logging operations.

Road Segment		Upgrade Cost
Tunnel Creek Road		\$132,900
Lakeview Road		\$98,400
Marlette/Hobart Road		\$78,400
	Total:	\$309,700

An additional consideration in using the existing road system for commercial tree removal operations is the potential impact on current recreation activities and backcountry experience, which includes hiking, mountain biking, and fishing. Staff anticipate completing a Backcountry Access Plan for the Marlette-Hobart Backcountry this winter that is focused on enhancing the user experience through reduction or restriction of motorized vehicle use. Although any impacts to recreational activities are expected to be short-term in nature, solutions to potential conflicts between recreation users and commercial logging operations will be addressed during this process.

Cultural Resources

Cultural resources encompass the physical remains of past cultures, including prehistoric archaeological sites and historic buildings and structures. A primary responsibility of the Park is to identify, protect, and interpret these cultural resources under its jurisdiction. Many notable historic resources related to the Comstock logging era are found within the park, including Red House and Hannah's Cabin, various other cabin or work sites, log and water flumes, railroad grades, and the Marlette Lake Water System infrastructure.

Prior to the implementation of any forest management activities, cultural resource evaluations need to be completed in coordination with the State Historic Preservation Office. These evaluations have been completed for the highest priority areas, but not for the majority of the project areas. The most cost effective approach, which would also provide for expedited project planning and implementation, would be to complete a comprehensive cultural resources survey for all of the priority project areas that have not been covered to date. This approach was used for 2,500 acres in Lake Tahoe Basin portion of the Park in 2001 to expedite the implementation of EIP forest management projects at a cost of approximately \$46/acre. Using this as a basis for cost, a similar effort for 1,100 acres would cost approximately \$50,600. During project implementation, resource protection measures will be utilized, including flagging and avoiding designated areas and stopping work if any cultural or historic resources are encountered during implementation.

Wildlife and Vegetation Resources

Vegetation in the eastern portion of the Park includes a number of different trees species, including white fir (*Abies concolor*), red fir (*Abies magnifica*), Jeffery pine (*Pinus jeffreyi*), sugar pine (*Pinus lambertiana*), incense cedar (*Calocedrus decurrens*) and lodgepole pine (*Pinus contorta* var. *murrayana*). Manzanita (*Arctostaphylos* spp.), huckleberry oak (*Quercus*

vaccinifolia), ceanothus (Ceanothus spp.) bitterbrush (Purshia tridentata) and squawcarpet (C. prostratus) form the majority of the understory shrub components. No sensitive plant species are known to occur in the area. The average age of dominants and co-dominants trees is approximately 90 years old, with ages ranging from 70 to 140 years. Riparian species, such as several species of willow, creek alder, dogwood, and aspen inhabit wetter areas along lakes and streams.

These vegetation types support a variety of wildlife species, including common species such as red-tailed hawk (*Buteo jamaicensis*), Stellar's jay (*Cyanocitta stelleri*), coyote (*Canis latrans*), black bear (*Ursus americanus*), raccoon (*Procyon lotor*), and mule deer (*Odocoileus hemionus*). More sensitive species, such as the federally listed bald eagle (*Haliaeetus leucocephalus*) and State-listed species including osprey (*Pandion haliaetus*), northern goshawk (*Accipiter gentilis*), snowshoe hare (*Lepus americanus tahoensis*) and mountain beaver (*Aplodontia rufa*) may also occur. As mentioned previously, planning and implementation will be coordinated with staff from NDOW and NNHP to protect vegetation and wildlife resources.

Funding Strategy

Overall Funding

A number of funding opportunities are being pursued to accomplish fuels reduction and forest restoration projects within the Park, which are summarized in Table 2. Most recently, the Nevada State Legislature authorized the expenditure of \$150,000 for fuels reduction projects with Lake Tahoe Nevada State Park through SB 226. This funding will to be used to leverage other sources of grant funding and potentially provide the basis for future forest management funding requests in the Park. At this time, a grant request has been submitted for an additional \$250,000 from the State Fire Assistance Program to match SB 226 funding.

Following the 2004 Waterfall Fire, the NDSP became eligible and pursued a grant from the Federal Emergency Management Agency through that agency's Hazard Mitigation Grant Program. Environmental documentation (NEPA) for the grant application has been completed and grant approval was received in September 2007. NDSP will use \$29,067 in agency funding to match \$87,202 in grant funding. In addition to providing immediate assistance for project implementation, the successful award of the grant is anticipated to serve as the basis for future funding requests through this program.

NDF is providing \$82,200 in Steven's Bill funding for NDF conservation camp crews and seasonal firefighters. These crews are anticipated to begin work September 2007, conducting thinning and burning activities.

Two grant requests totaling \$430,910 have also been submitted for funding through the Southern Nevada Public Land Management Act (SNPLMA) Round 8. The projects have recently been recommended for funding by the SNPLMA project review committee. The recommended project list will be forwarded to the Executive Committee for further review and refinement, and eventually may be approved by the Secretary of the Interior in October 2007. If the requests are approved, this will represent a significant funding source for fuels reduction work in the Park. It is important to note that funding approval will also require completion of the Carson Range Comprehensive Fuels Reduction Plan. As described previously, this plan is a cooperative effort between local, state, and federal entities to identify and prioritize fuels reduction projects in the Carson Range, which is scheduled to be completed in November 2007.

Table 2. Summary of funding sources for fuels reduction work in Lake Tahoe NV State Park.

Funding Source	Grant Source	Receiving Agency	Grant Amount	State Match	State Match Source	Total Amount
State Fire Assistance Program	NDF	NDSP	\$250,000	\$150,00	SB 226	\$400,000
Hazard Mitigation Grant Program	FEMA	NDSP	\$87,202	\$29,067	*see below	\$116,269
Steven's Bill	Federal	NDF	\$82,200		n/a	\$82,200
SNPLMA Round 8 – Franktown Ck	BLM	NDF	\$329,540	[†] \$112,700	In kind	\$442,240
SNPLMA Round 8 – Spooner	BLM	NDF	\$101,370	[†] \$60,500	In kind	\$161,870
		Total:	\$850,312	\$352,267		\$1,202,579

^{*}Agency match from User Fee Overage (\$14,117) and Park Woodsale Account (\$14,950)
†Match primarily in-kind staff time and equipment

Finally, the Nevada Department of Wildlife (NDOW) is developing an approximately 40-acre riparian enhancement project adjacent to several fuels management projects within the Park through an approximately \$70,000 grant from the Nevada Division of State Lands (NDSL) Question 1 grant program. This project, scheduled for implementation in 2008 and 2009, will complement NDSP/NDF fuels management projects by reducing biomass and ladder fuels while providing habitat enhancements.

Expenditure of SB 226 Funding

Senate Bill 226 provides \$75,000 to Parks effective July 1, 2007 and another \$75,000 on July 1, 2008. The total amount of \$150,000 must be committed for expenditure by July 1, 2009 and spent by September 18, 2009. In order to utilize the SB 226 funding within these timeframes, a 10-person Nevada Conservation Corps (NCC) hand crews hand crews will be contracted to complete fuels reduction work during the 2008 and 2009 seasons for approximately 23 weeks.

NCC crews provide a dedicated workforce for restoration and forest management projects. Given the timeline in which to develop and set up projects, implementation seasons, availability of NDF crews, and time to contract for services, staff believe contracting with the NCC is the most appropriate mechanism to utilize the available funding. Depending upon site conditions, it is anticipated that the NCC crew will complete between 45 - 60 acres of treatment in Priority 1 or 2 project areas at a treatment cost of approximately \$2,500 to \$3,500 per acre. Other grant funding sources will be used to complete work such as pile burning in the project areas by NDF Conservation Camp crews during the winter months.

Revenue

Although opportunities to generate revenue from the implementation of fuels reduction projects are limited, staff anticipates pursuing several options to generate revenue to offset project costs. These include commercial timber sales, annual fuel wood sales, and biomass utilization.

Much of the forest fuel requiring treatment is comprised of low quality or small diameter timber that generally does not have commercial value, especially relative to the costs of removal, transport, and processing. The latter is particularly problematic, as the nearest processing mills in Loyalton and Camino have recently closed, creating a significant increase in costs. However, opportunities to offset costs through commercial sales will be explored in all project areas.

Parks staff has administered annual fuel wood sales for a number of years and it is anticipated that the proposed fuels reduction projects will create significant levels of fuel wood that can be made available to the public. On average, recent sales have included the yearly disposal of 100 to 125 cords of wood, but have been as much as 400 cords in some years. Using the \$45 permit cost for 2007, fuel wood sales generate \$4,500 to \$18,000 for the Park annually. The proposed projects will likely create larger volumes of fuel wood, which can then be used to assist with funding additional fuels reduction work. Concurrent with increased volume, Parks anticipates increasing the permit cost per cord to better reflect the current economic value of the material.

Delivery of biomass material to an energy conversion facility generates revenue based on the tonnage of material, which is offset by the associated transportation costs to get material to the facility. Current estimates obtained by NDF for a roll off hauling dumpster that could hold 14 tons of chip material are approximately \$350 per week. At current pay rates of \$28.50 per ton of material at NNCF, this would generate nearly \$400 in revenue and effectively cover all hauling costs. Although there would be little net revenue to pay for additional forest management work, this type of biomass utilization would assist

in completing the project in a timely manner and potentially reducing costs by eliminating the need for crews to burn slash piles.

Tracking of revenue generated from commercial sales, fuel wood, or biomass will be required and is dependent upon the funding sources used to implement the project. Revenue generated from the sale of timber, fuel wood, or biomass material and that is associated with projects funded through SB 226 will be deposited into Budget Account 4605, while revenue associated with grant funded projects will be deposited into a separate Budget account and tracked as additional match funding.

Future Need

Funding SB 226 and the grant sources outlined above are anticipated to treat only a portion of the planned project areas, approximately 350 acres. Using an estimated cost of \$3,500/acre for treatment, the estimated need in 2007 dollars to complete 1,153 acres in the remaining priority areas is \$4,035,500. This is only an estimation of cost, which may increase due to site conditions or be offset through revenue generation. Funding is also needed to complete road upgrades and a comprehensive cultural resources survey, as discussed previously.

Other funding opportunities will be pursued as they present themselves. These include: SNPLMA Round 9 and 10; future Steven's Bill funding (up to \$75,000 available annually); State Fire Assistance Program funding; biomass utilization grants from the USDA, USDOE, and the State of Nevada; and future FEMA HMGP funding tiering off of the current anticipated grant. Staff will explore the possibility of using State funding that is planned to be used for forest management within the Lake Tahoe Basin portion of the Park through the Environmental Improvement Program (EIP) as a match for the above grants.

SB 226 Implementation Schedule

Funding from SB 226 is being used as match for the State Fire Assistance Program (SFAP). Therefore, timing to prepare the work program and related contracts will occur following award notification of the grant. Note that, if awarded, NDF conservation camp crews will be funded using the SFAP grant.

CY 2007 September 30 October 1 – 31 October 1 – 31	Approximate award of SFAP grant (\$250,000) Prepare SB 226 work program and NCC contract for 2008 Prepare SFAP work program and NDF contract for 2008
CY 2008 June 2 – Aug 15 July 1 – July 30 Sept – Dec	NCC crew field thinning Amend NCC contract with additional \$75,000 NDF Cons Camp crew thinning, pile burning
CY 2009 March – June June 1 – Aug 14 Sept – Dec	NDF Cons Camp crew thinning, pile burning NCC crew field thinning NDF Cons Camp crew thinning, pile burning

Maintenance and Monitoring

The priority projects outlined above are considered "first entry" treatments in order to address forest management issues that have developed over many decades. Maintenance of these areas will be required in the future and could include additional hand crew work, entries into adjacent areas, and prescribed fire. If not maintained, these areas will revert to an unsafe and unhealthy condition.

Annual monitoring of the treated areas will be scheduled in order to identify any issues that may occur as a result of project implementation. These may include: remediation activities necessary to control surface erosion; noxious weed response to thinning and mastication; the area's response to additional surface biomass in the form of chips and scattered logging slash; herbaceous and shrub response to increased sunlight; conifer reproduction response; and allow for earlier detection of insect and disease problems within and bordering the project area. Monitoring will consist of field visits with staff resource specialists and the establishment of permanent photo points.

Acknowledgements

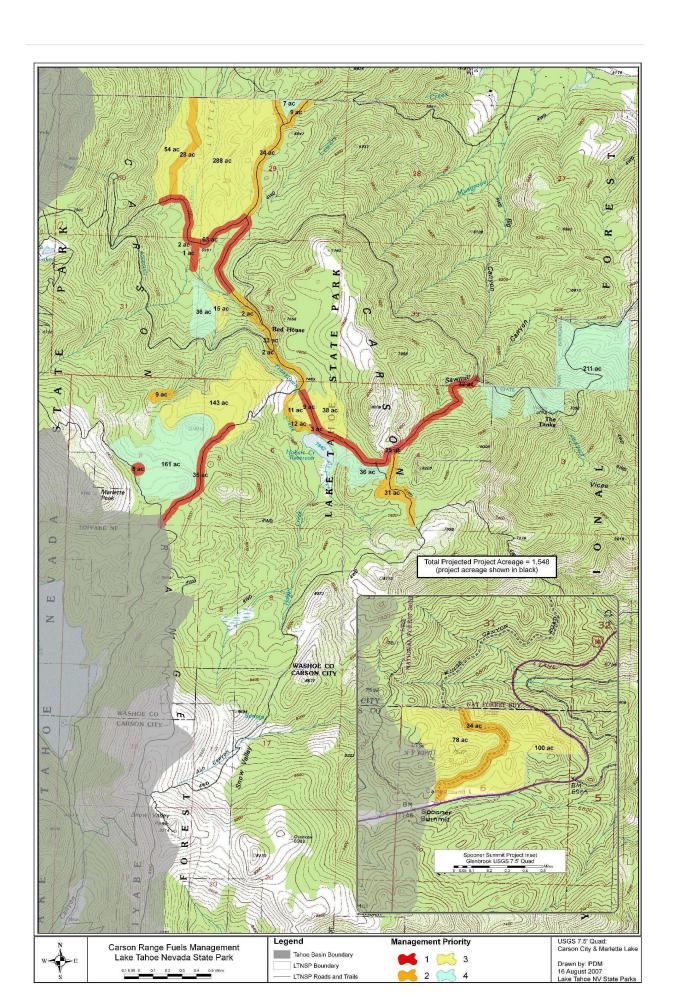
This report was prepared with input, analysis, and review from the following individuals:

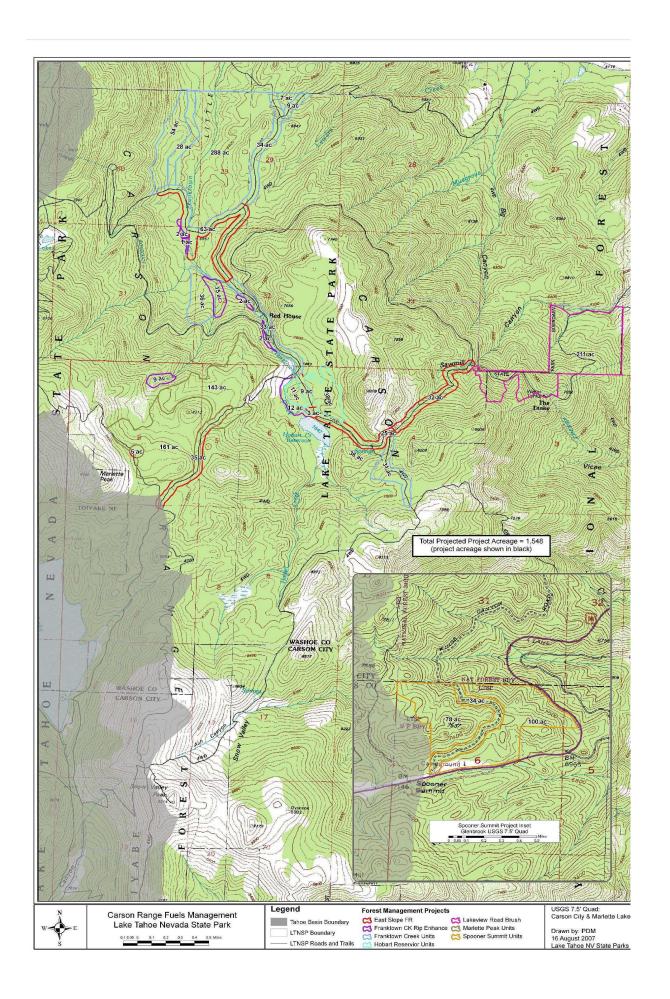
- Pete Anderson, NDF
- Charlie Donohue, NDSL
- Jason Perock, NDF
- Jay Howard, NDSP
- Jenny Scanland, NDSP
- Joe Cyphers, NDSP
- John Christopherson, NDF
- John Copeland, NDF
- Ned Wallace, NDSP
- Peter Maholland, NDSP
- David Morrow, NDSP

References

imagery.

Federal Emergency Management Agency (FEMA). 2007. Final Environmental Assessment, Lake





Appendix L – Nevada	Tahoe	Resource	Team	GIS	Procedures	Manual
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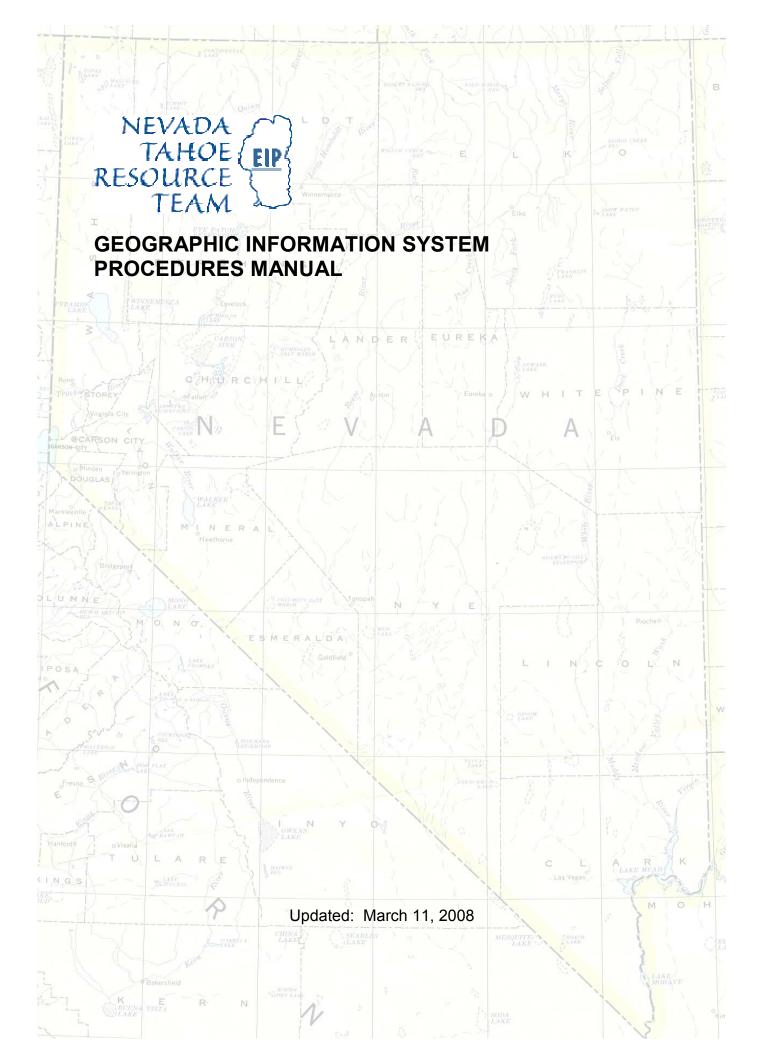


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Use

The Nevada Tahoe Resource Team utilizes existing and user-created GIS data for analysis, tracking, reporting, permitting, and graphic displays. This *NTRT GIS Procedures Manual* establishes guidelines and procedures designed to ensure that all NTRT members can:

- have access to all applicable GIS data;
- be assured that the data they are accessing is the most current and accurate;
- be able to identify basic information regarding the data sources (i.e., metadata);
- more easily respond to graphic data requests (greater team meetings, EIP updates, etc.), and;
- easily communicate to new team members how data are organized.

The manual is intended to be a dynamic document that is updated frequently to reflect changes in procedures and structure. As such, the manual is centrally stored electronically in the main NTRT GIS:

G:\TAHOE\GIS Procedures Manual NTRT

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NTRT GIS File Structure

As noted above, this manual applies specifically to the NTRT GIS. Nearly all NTRT GIS data are located in the following network directory:

G:\TAHOE\

NTRT GIS directories are organized based on data type and EIP projects. Additionally, there are specific folders for GPS downloads and map projects. The current file structure, along with a description of typical folder components, is located in **Appendix A**. Specific naming conventions for files and directories are described below.

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File and Folder Naming Convention

The NTRT has developed a specific naming convention for all GIS data and associated files to allow other users to easily identify and locate the data they are working with or looking for. The general naming convention for user-created data is to include basic file information in the following format:

location what it is additional description date created projection

Examples: NorthCyn MarletteTrail planned 04Feb2005 NAD27U10

TunnelCk_aspenstand023_05Jun2006_NAD83U11 LTSNP soilmonitor stations 26May1999 NSPCSW Standard abbreviations should be used for dates (two digit day, three letter month appreviation, four digit year) and projection (NAD 27 and NAD 83, UTM – U, NV State Plane Coordinate System - NSPCS).

Folders generally do not follow the file naming convention, since information regarding folders is documented in **Appendix A**. When naming folders or files, it is important to <u>avoid</u> including spaces and special characters in the name. Often when data transformation is needed (e.g., import/export), spaces or special characters in <u>any</u> file or folder name in the tree can cause problems. Additionally, avoid using staff names ("Tim's Projects"). To create space, use underscores.

When possible, data obtained from outside sources should be renamed to conform to the NTRT naming convention. However, agency specific data may retain the original name to avoid confusion and facilitate updates.

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Data Management

Standards and procedures for data management of the NTRT GIS are outlined below.

File Locations – Generally, Tahoe and EIP-related GIS data are stored in the NTRT GIS directory (G:\TAHOE\). However, data such as imagery, elevation models, and county-or state-wide data are typically stored on the State Lands or DCNR GIS servers. Users should contact the GIS administrator to ensure they have access to the both servers.

File Centralization – To ensure that all NTRT members have access to all applicable GIS data, all user-created and Tahoe-specific files should be located in the NTRT GIS directory (G:\TAHOE\) in the appropriate folder and not in individual or other network directories.

Old or duplicative files – Old versions or copies of files should be deleted and only the most current versions retained to reduce confusion. The GIS administrator or their designee may, on a quarterly basis, delete older versions or copies of files. When necessary, older files may be saved in the "G:\TAHOE\History" directory.

GPS downloading – GPS files are downloaded into the following directory:

G:\TAHOE\GPS Download

and converted into GIS feature data sets (shapefile, etc.) as soon as possible. Frequently, files names retain defaults, such as exp0723b, and do not indicate what the file is. GPS files should be dealt with in the same manner as other GIS data, following naming conventions and metadata requirements. Additionally, once GPS data has been converted into a GIS coverage, the original GPS file should be deleted from the download directory. GPS files in the "GPS_Download" directory older than thirty (30) days old will be deleted by the GIS administrator or their designee.

Geographic Focus - It may be useful to clip regional and statewide data to our working area (Tahoe east shore and Carson Range east slope) to facilitate quicker map generation and analysis. When creating clipped data from an existing feature dataset, follow the naming convention and save the data set in the appropriate subdirectory within G:\TAHOE in the adopted projection (NAD 83 UTM 11N).

Projection - Projection information is critical, but documentation is frequently lacking for most files. Projection information is a required metadata element (see below). All NTRT data is kept in the same projection, **NAD83**, **UTM Zone 11N** (NAD83U11), since the Nevada side of the Lake Tahoe Basin and the east slope are located in UTM Zone 11N. Note that much of the existing Tahoe data are project in UTM zone 10N and utilizes the less accurate NAD 27 reference datum. These data should be reprojected and saved using the adopted naming convention.

Be sure to define the projection of your data using ArcCatalog (contact the GIS administrator for assistance, if necessary). ArcCatalog automatically creates a metadata record and fills in what it can gather from a dataset such as information about the coordinate system, bounding coordinates, features, and attributes. However, ArcCatalog cannot automatically document projection and datum unless they have been defined, which can cause difficulties in bring data into a map project.

Metadata – In relation to GIS, metadata is the documentation that describes the attributes and contents of the GIS layer, and provides the critical information necessary to help the user understand, evaluate, acquire, and use a dataset. The NTRT has adopted minimum requirements for metadata for all of our data. There are different levels, but at a minimum we should always be able to determine:

- who created the data
- date the file was created or modified
- brief description of what it is
- what the projection of the data is

ArcGIS has tools to create metadata (using Arc Catalog), though Readme text files are useful too in providing the minimum required information. Procedures on how to create metadata using Arc Catalog are found in: **Appendix B**. Using Arc Catalog is the preferred metadata tool, as additional information beyond the minimum required can be easily included, and the information "travels" with the data automatically. Basic procedures to create a ReadMe text file, along with sample text, can be found in **Appendix C**.

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Templates

Templates allow for the uniform creation of maps for projects and presentations, add a level of professionalism, increase map generation efficiency, and allow users to easily identify important information about who created the map, when it was created, and what

data was used. Map templates are not required, but will be available for NTRT members and will be located in:

A sample map template is located in **Appendix D**.

Additionally, a map project (.mxd) for the east side of the Tahoe Basin containing general data for generating quick maps is saved as "G:\TAHOE\Tahoe.mxd". This project may be opened, saved under a different name in the appropriate G:\TAHOE\Maps\ directory, and data turned on or off as needed.

Template creation and use procedures are under development. To use a template:

1. Open up ArcMap,

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Appendix A – File Structure Outline and Descriptions

The follow displays the file directory trees for GIS information for the Nevada Tahoe Resource Team (main directories are in bold). Typical types of data that may be found in a directory are indicated in brackets "[]" after the directory name. NTRT directories may include data already included in the State Lands or DCNR GIS, but these data may be reprojected into the NTRT standard (NAD83 UTM11N) or clipped from a larger dataset. Screenshots of current folders and subfolders follow.

GIS/TAHOE/

Data

Base [DEMs/NEDs, DLG, DRG, slope, aspect, contours] Cultural [cultural features, place names, restricted areas] [wildfire boundaries, fuel models] Fire Hydrologic [watershed boundaries, streams, lakes] [clipped, re-projected, or area-specific imagery] **Imagery** Land Use [TRPA Plan Area Statements, Zoning, nontransportation related infrastructure] [EIP project and agency data] Monitoring Parcel Ownership [boundaries, parcels, districts, private ownership] Recreation [trails, campsites, features, place names] Soils Geology [basin soils, geology layers, land capability] [roads, highways, USFS system roads] Transportation [vegetation layers, USFS forest types, sensitive Vegetation species, insects and disease mapping] [sensitive species observations, habitats, fisheries] Wildlife [temporary storage of downloaded data] [older files that are not deleted] [map projects by EIP program and templates]

GPS Download

History Maps

> Map Templates Forest Restoration Old Growth Recreation Riparian Stream Restoration Urban Lot Mgmt Water Quality

NTRT Projects

Wildlife

[EIP and related projects, project specific data such

as CAD or building locations]

Forest Restoration Old Growth

Parks Recreation

Riparian

Stream Restoration

[trails, trailhead infrastructure, day use areas]

[templates for creating various map projects]

[aspen, riparian vegetation restoration]

Urban Lot Mgmt [urban lot program files such as treated

lots or parcels with licenses]

Water_Quality [grant or direct projects]

StateLands [NDSL specific work or projects in the Tahoe

Basin]

Bouy Checks

MarletteWaterSystem

Ponderosa Slaughterhouse

Other relevant data may be found in additional directories, as indicated below.

GIS/WASHOE/

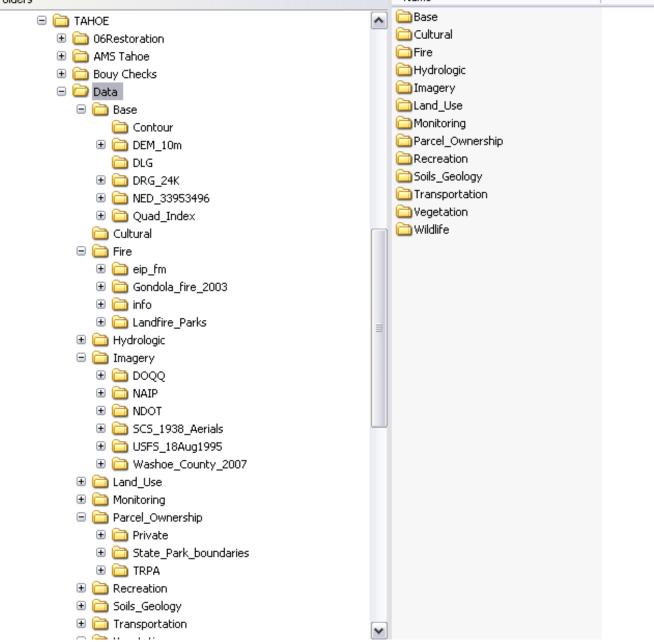
Parks25 [State Lands information related to Lake Tahoe

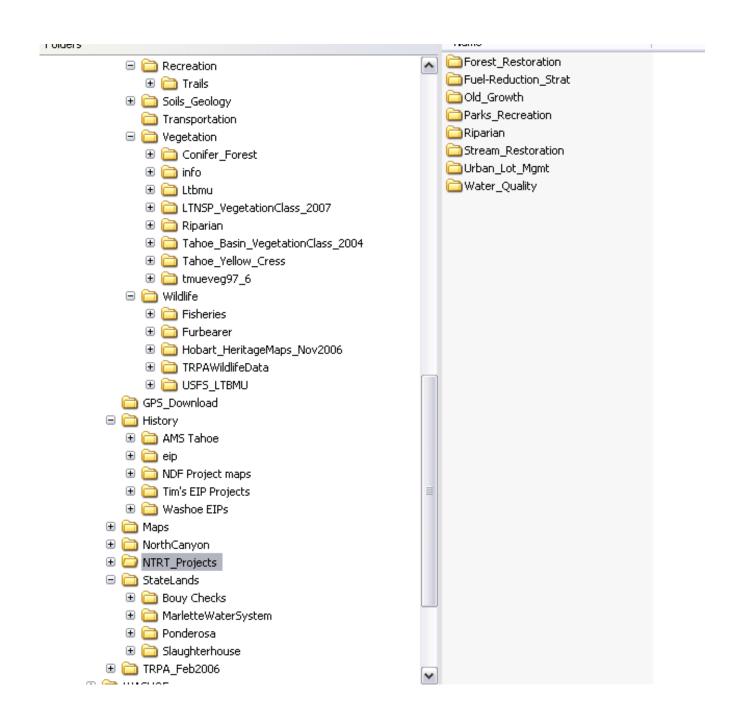
Nevada State Park, including legal description and

associated shapefile]

GIS/NAIP/

County [2006 NAIP imagery by county]





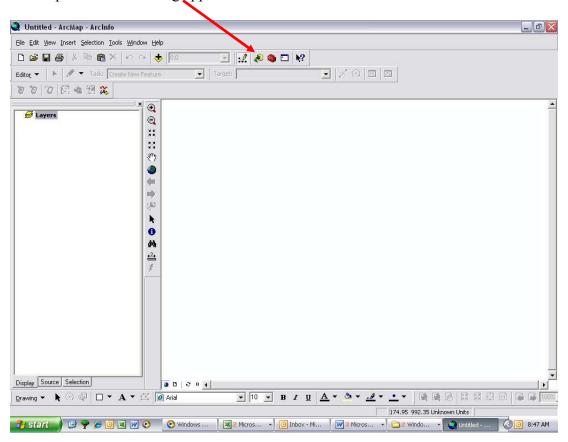
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Appendix B – Procedure for Creating Metadata using ArcCatalog

The following was modified from USFS procedures and provides an overview for developing basic metadata for NTRT feature data sets using Arc Catalog. Additional information is available in the application's Help menu.

Metadata Creation Procedure

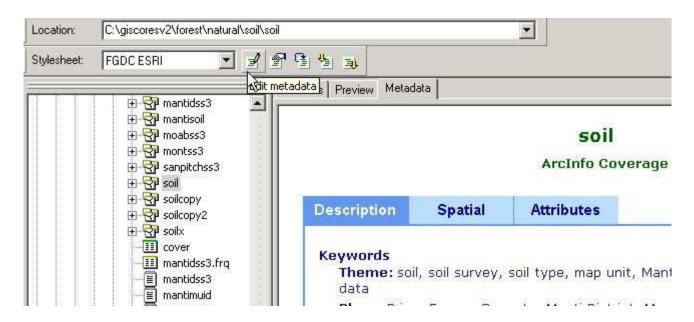
1. Open the ArcCatalog application



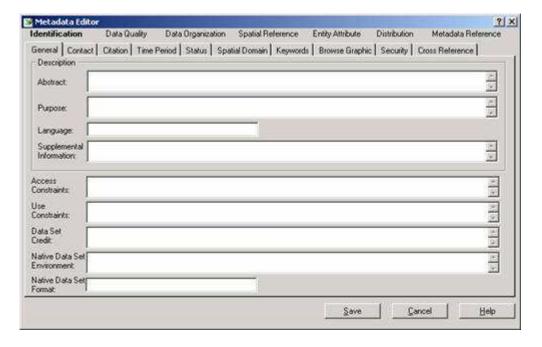
2. Click the create/update button



3. Locate the dataset to edit in the ArcCatalog tree and click the metadata tab. Then click the Edit button as shown below to start the Metadata Editor window.



In the Metadata Editor window, there are the seven tabs representing broad FGDC metadata sections: Identification, Data Quality, Data Organization, Spatial Reference, Entity Attribute, Distribution, and Metadata Reference. As a metadata section is selected, its name is bolded and several tabs appear in the row immediately below and represent groups of metadata elements that go with the selected section.



- 4. Enter metadata into the fields under the appropriate sections and elements (FGDC required fields in red).
- 5. When you have completed your edits, click Save and the Metadata Editor window will close. Click the Create/Update button to update the metadata record after editing.

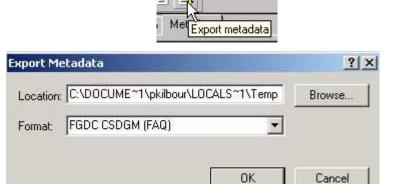


Metadata Exporting and Publishing Procedure

ArcCatalog by default stores your metadata in XML format. If the dataset is a coverage, the file is stored as 'metadata.xml' within the coverage folder. If the dataset is a shapefile, the metadata file is stored with the same name as the dataset but with the xml extension within the same folder. If the dataset is a personal geodatabase, the metadata is stored in a metadata table within the geodatabase. The metadata reside with your dataset and will travel with your dataset automatically when you copy, move, or export it. When someone imports, the metadata will be visible in ArcCatalog.

Metadata files may be exported into HTML formats in ArcCatalog and saved with a coverage.

1. In ArcCatalog, click on the Export Metadata button



2. Select the desired location, file name, and metadata format and click OK. FGDC CSDGM (HTML) is the standard FGDC look with hyperlinks for navigation. FGDC CSDGM (FAQ) uses hyperlink attached to common 'who', 'what', 'where', 'when', 'why', and 'how' questions about the data.

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Appendix C – Procedures and Sample Metadata ReadMe file

Procedures

- 1. Open Notepad (Start \rightarrow All Programs \rightarrow Notepad)
- 2. Type in minimum metadata using the following format:

Created by: last name, first name
Date created: day Month year
Description: description
Projection: projection

- 3. Add in any additional information, if desired.
- 4. Save the text file in the same directory as the GIS file, using the original GIS file name followed by "ReadMe". Example:

Original File: TunnelCk aspenstand023 05Jun2006 NAD83U11

Read Me file: TunnelCk_aspenstand023_05Jun2006_NAD83U11_ReadMe

Sample Metadata

Created by: Maholland, Peter Date created: 28 January 2007

Description: Data created from GPS data of three aspen stands, GPS'd on 12 Dec 2006.

File consists of three polygons representing the stand perimeters.

Projection: NAD 83, UTM Zone 11N

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 $Appendix \ D-Sample \ Map \ Template$



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Appendix M – State Parks Policy 35-2, Special Area Designations



Division of State Parks

Parks & Rec.	Special Area Designations	Rev.	Page
Planning #35-2		3/17/09	1 of 2

REFERENCES:

PURPOSE: To distinguish areas under the jurisdiction of the Division of State Parks that have unique features and values worthy of special designation and to provide parameters for their long-term management as established through the general management plan development process.

ORGANIZATION: Division staff will use an established system for the designation of areas which exhibit unique resource qualities within state park units.

PRIOR POLICY: This policy supersedes the prior policy dated 8/31/1998.

PROCEDURES

- I. Designations of Special Areas will be made as follows:
 - A. Natural Area
 - B. Primitive Area
 - C. Cultural Area
- II. Implicit in the designations are a set of specific criteria and management objectives. The designations are defined by the following criteria:
 - A. Natural Features/Scenic Qualities: types and degree of emphasis. (Attachment A)
 - B. Primitive Features: Unique settings with opportunities for solitude and limited or non-existent motorized use. (Attachment B)
 - C. Cultural Features: types and degree of emphasis. (Attachment C)
 - D. Development: Relationship to resource management objectives, degree of development, carrying capacity and impact to the resource.
 - E. Relationship of recreational activities to resource management objectives and emphasis.
 - F. Size: objectives.
 - G. Location: objectives.
 - H. Visitor Services: range of types and desired lack of services.
 - Significance: degree of significance.
- III. Identification of special areas and designation will occur only through the planning process involving development of a general management plan.

NOTE: Special areas have unique resource characteristics requiring additional protection provided by special designation. A state park unit may or may not have areas of special designation identified and designated within them.

Parks & Rec.	Special Area Designations	Rev.	Page
Planning #35-2		3/17/09	2 of 2

Original signed by:	
David K. Morrow, Administrator	Effective Date
Original signed by:	
Allen Biaggi, Director	Date

Review Date:_____

Natural Area Criteria

Definition:

A natural area designation within any unit administered by the division must be primarily a consequence of outstanding natural features and are intended to promote experiences closely associated with plant or animal communities or geological formations or scenic features of statewide significance. The management emphasis will be on the natural feature(s). The area must deserve special status for increased protection or preservation. A natural area may be identified on the ground with appropriate signs and will be designated in the relevant master plan. The area will be managed in accordance with the following criteria:

- 1. Natural areas will be designated to preserve, protect and portray natural feature(s) or processes of ecological, geological, palentological or other scientific or similar values.
- 2. Cultural features of historical, archaeological or other significance may exist in the area, but they are of secondary importance in management.
- 3. Development will be strictly limited to facilities which compliment or help to preserve, protect or portray the natural feature(s) present, provide public access and protect public health. All development will be planned and executed so as not to impair, damage, or detract from the natural values for which the area is designated to preserve and protect. Carrying capacity will be low.
- 4. Recreational activities will be strictly limited to passive activities. Such activities will not impair, damage, or detract from the natural values. Emphasis will be placed on educational activities.
- 5. Natural areas should be adequate in size and have appropriate boundaries to; a) completely include the natural feature(s) the designation is intended to preserve and protect; b) provide a buffer/barrier area to protect the natural feature(s) from outside influences or encroachments; c) permit the development to interpretive devices if these can be provided without damage or impairment of the primary purpose of preserving the natural feature(s).
- 6. Location must be based on inherent qualities and not geographic, demographic or other factors.
- 7. Visitor services will be strictly limited to interpretation, health protection and safety. Recreational facilities, i.e., primitive camping and picnic facilities, may be provided to facilitate the public's visits to the site. However, since these facilities and activities are secondary to the area's purpose, they should be, located on the perimeter of the area or otherwise be non-obtrusive.
- 8. Generally, non-outdoor recreational uses will not be permitted.

Primitive Area Criteria

Definition:

Primitive area designation will be to protect a unique natural setting in which the opportunity for solitude is the dominant feature. An area of this designation may be contained within any unit administered by the division. Such an area is managed primarily to prevent degradation of natural conditions, opportunities for solitude or primitive recreation and special features. Motorized use within a primitive area will be limited or non-existent. Such an area must deserve special status for increased protection or preservation. A primitive area may be identified on the ground with appropriate signs and will be designated in the relevant master plan. It will be managed in accordance with the following criteria.

- 1. A primitive area is essentially an unmodified natural environment. Outstanding natural or scenic features may be present. However, a sense of solitude is the dominant feature.
- 2. Cultural features are normally non-existent or at least very unobtrusive.
- 3. Development will be strictly limited to facilities that compliment and/or preserve the natural features and solitude, provide public access and protect public health. Development will be planned and executed to not impair, damage or detract from the natural values for which the area is designated to preserve and protect. Carrying capacity will normally be relatively low.
- 4. Recreation will be strictly limited to passive activities appropriate for the protection of the primitive area and its resources. Such activities will not impair, damage or detract from the natural values.
- 5. A primitive area is an identifiable geographical area with natural boundaries, generally at least 5,000 acres, but may be smaller if the area is a unique entity.
- Location should be based on a combination of inherent qualities and geographical distribution.
- 7. Visitor services will be strictly limited to information, protection and safety.
- 8. Primitive areas will be of statewide or multiple-county rather than local significance. The area will provide recreational opportunities capable of attracting visitation appropriate within the capacity of the resource.
- 9. Non-recreational uses may be considered, provided they have little or no impact on visitors' experience and area objectives.

Cultural Area Criteria

Definition:

Cultural areas within any unit administered by the division are designated to preserve and protect historical and archeological resources. They are intended to provide a direct link for the park visitor with Nevada's past. Such an area can include historical buildings or a group of historical buildings, battlegrounds, town sites, significant sites of native culture, historical trails or routes, arts or other sites associated with a significant person or event. A cultural area may have a variety of complimentary visitor facilities while a historic site will have little or no complementary development. The management emphasis for both types should be on the historical or cultural features. The area must deserve special status for increased protection or preservation. A cultural area may be identified on the ground with appropriate signs and will be designated in the relevant master plan. It will be managed in accordance with the following criteria:

- 1. Natural features, which maintain the integrity of the site and/or are necessary to enhance the cultural, historical or other significance of the area, will be maintained.
- 2. The area must contain an identifiable site, artifact and/or structure capable of being interpreted.
- 3. Development may include interpretation, stabilization, restoration and/or reconstruction of historical or archeological features and should be planned and executed to help the visitor develop a historical and prehistorical perspective. Any additional development will be in a style and design which is supportive to the objectives of interpretation, safety and management.
- 4. Recreational activities will compliment the cultural values, and will be appropriate for natural surroundings. Emphasis will be placed on passive recreational activities. Recreational activities area secondary to the area's purpose.
- 5. Cultural areas will be adequate in size to: a) completely include the historical or archeological feature(s) the area is designated to preserve and protect; b) provide sufficient land area to protect the feature(s) from outside influences or encroachments; c) permit the development of interpretive devices of these can be provided without damage or impairment of the primary purpose of preserving the feature(s).
- Location must be based on inherent qualities and not geographic, demographic or other factors.
- 7. Appropriate visitor services may be provided. Recreational facilities, i.e. camping and picnic facilities are secondary and should be located on the perimeter of the area or otherwise non-obtrusive.
- 8. Cultural areas will portray items, sites or places of historical occurrences which played a prominent role in the State's history and which command statewide interest.
- 9. Non-recreational uses will not be permitted.

Appendix N – Minimum Impact Suppression Tactics (MIST) for Wildland Fire Suppression

MINIMUM IMPACT SUPPRESSION TACTICS GUIDELINES

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CONCEPT

The concept of Minimum Impact Suppression Tactics (MIST) is to use the minimum amount of impact necessary to effectively achieve the fire management protection objectives consistent with State Parks resource management objectives. It requires a greater sensitivity to the impacts and long-term effects of suppression tactics when determining how to implement an appropriate suppression response. For example, MIST may indicate cold trailing or wet line may be more appropriate than constructed hand line. Individual determinations will be dependent on the specific situation and circumstances of each fire. MIST is not intended to represent a separate or distinct classification of firefighting tactics, but rather a mind set of how to suppress a wildfire while minimizing the long-term effects of the suppression action.

Suppression actions on all wildfires within Lake Tahoe Nevada State Park will be selected to have a minimum impact on the resources associated with each site, with the understanding that providing for safety first will not be compromised. The key challenge to the line officer, fire manager and firefighter is to be able to select the wildfire suppression tactics that are appropriate given the fire's probable or potential behavior. When selecting an appropriate suppression response, firefighter safety must remain the highest concern. In addition, fire managers must be assured the planned actions will be effective and will remain effective over the expected duration of the fire.

MIST may result in an increase in the amount of time spent watching, rather than disturbing, a dying fire to insure it does not rise again. Additional rehabilitation measures on the site may also be necessary.

GOAL

The goal of MIST is to halt or delay fire spread in order to maintain the fire within predetermined parameters while producing the least possible impact on the resource being protected. These parameters are represented by the initial attack incident commander's size-up of the situation, in the case of a new start, or by the Escaped Fire Situation Analysis (EFSA) in case of an escaped fire. It is important to consider probable rehabilitation need as a part of selecting the appropriate suppression response. Tactics that reduce the need for rehab are preferred whenever feasible.

SUPPRESSION RESPONSIBILITY

As stated previously, safety is the highest priority. All action will be anchored to the standard fire orders and watch out situations. Safety will remain the responsibility of each person involved with the incident. Position responsibilities during suppression relative to MIST are outlined below.

Initial/Extended Attack

Incident Commander – To understand and carry out an appropriate suppression response that will best meet the land management objectives of the area at the least cost plus loss. Insure all forces used on the fire understand the plan for suppressing the fire in conjunction with MIST. Coordinate with Park Supervisor to implement appropriate MIST. Keep in communication with responsible fire management or line officer to insure understanding and support of tactics being used on the fire. Evaluate and provide feedback as to the tactical effectiveness during and after fire incident.

Project Fire

Type 1/ Type 2 Incident Commander – To carry out instructions given by the responsible line officer both verbally and through the EFSA. Establish a close dialogue with the resource advisor assigned to the fire team. Coordinate with Park Supervisor to implement appropriate MIST. Review actions on site and evaluate for compliance with land line officer direction and effectiveness at meeting fire management protection objectives.

Responsible Line Officer – To transmit the land management objectives of the fire area to the fire team and to define specific fire management protection objectives. Periodically review for compliance.

Resource Advisor – To insure the interpretation and implementation of EFSA and other oral or written line officer direction is adequately carried out. Provide specific direction and guidelines as needed. Participate at fire team planning sessions, review incident action plans and attend daily briefings to emphasize resource concerns and management's expectations. Provide assistance in updating EFSA when necessary. Participate in incident management team debriefing and assist in evaluation of team performance related to MIST.

GUIDELINES

Following is a list of considerations for each fire situation.

Hot-Line/Ground Fuels

- Allow fire to burn to natural barriers.
- Use cold-trail, wet line or combination when appropriate.
- If constructed fireline is necessary, use only width and depth to check fire spread.
- Consider use of fireline explosives for line construction.
- Burn out and use low impact tools like swatter or 'gunny' sack.
- Minimize bucking and cutting of trees to establish fireline; build line around logs when possible.

- Use alternative mechanized equipment such as excavators, rubber tired skidders, etc. rather than tracked vehicles. Use high pressure type sprayers on equipment prior to assigning to incident to help prevent spread of noxious weeds.
- Constantly re-check cold trailed fireline.

Hot-Line/Aerial Fuels

- Limb vegetation adjacent to fireline only as needed to prevent additional fire spread. During fireline construction, cut shrubs or small trees only when necessary. Make all cuts flush with the ground.
- Minimize felling of trees and snags unless they threaten the fireline or seriously endanger workers. In lieu of felling, identify hazard trees with a lookout or flagging.
- Scrape around tree bases near fireline if it is likely they will ignite.
- Use fireline explosives for felling when possible to meet the need for more natural appearing stumps.

Mop-up/Ground Fuels

- Do minimal spading; restrict spading to hot areas near fireline.
- Cold-trail charred logs near fireline; do minimal tool scarring.
- Minimize bucking of logs to extinguish fire or to check for hotspots; roll the logs instead if possible.
- Return logs to original position after checking and when ground is cool.
- Refrain from making bone yards; burned and partially burned fuels that were moved should be returned to a natural arrangement.
- Consider allowing large logs to burnout. Use a lever rather than bucking to manage large logs which must be extinguished.
- Use gravity socks in stream sources and/or a combination of water blivits and fold-a-tanks to minimize impacts to streams.
- Consider using infrared detection devices along perimeter to reduce risk.
- Personnel should avoid using rehabilitated firelines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehab work, i.e. water bars.

Mop-up/Aerial Fuels

• Remove or limb only those fuels which if ignited have potential to spread fire outside the fireline.

- Before felling, consider allowing ignited tree/snag to burn itself out. Ensure adequate safety measures are communicated if this option is chosen.
- Identify hazard trees with a lookout or flagging.
- If burning trees/snags pose a serious threat of spreading fire brands, extinguish fire with water or dirt whenever possible. Consider felling by blasting when feasible. Felling by crosscut or chainsaw should be the last resort.
- Align saw cuts to minimize visual impacts from more heavily traveled corridors. Slope cut away from line of sight when possible.

LOGISTICS

Campsite Considerations

- Locate facilities outside of wilderness whenever possible.
- Coordinate with the Resource Advisor in choosing a site with the most reasonable qualities of resource protection and safety concerns.
- Evaluate short-term low impact camps such as coyote or spike versus use of longer-term higher impact camps.
- Use existing campsites if possible.
- New site locations should be on impact resistant and naturally draining areas such as rocky or sandy soils, or openings with heavy timber.
- Avoid camps in meadows, along streams or on lakeshores. Locate at least 200 feet from lakes, streams, trails, or other sensitive areas.
- Consider impacts on both present and future users. An agency commitment to wilderness values will promote those values to the public.
- Lay out the camp components carefully from the start. Define cooking, sleeping, latrine, and water supply.
- Minimize the number of trails and ensure adequate marking.
- Consider fabric ground cloth for protection in high use areas such as around cooking facilities.
- Use commercial portable toilet facilities or existing backcountry facilities where available. If these cannot be used a latrine hole should be utilized.
- Select latrine sites a minimum of 200 feet from water sources with natural screening.
- Do not use nails in trees.
- Constantly evaluate the impacts which will occur, both short and long term.

Personal Camp Conduct

- Use "leave no trace" camping techniques.
- Minimize disturbance to land when preparing bedding site. Do not clear vegetation or trench to create bedding sites.
- Use stoves for cooking, when possible. If a campfire is used, limit to one site and keep it as small as reasonable and use designate fire rings if available. Build either a "pit" or "mound" type fire. Avoid use of rocks to construct new fire rings.
- Use down and dead firewood. Use small diameter wood, which burns down more cleanly.
- Don't burn plastics or aluminum "pack it out" with other garbage.
- Keep a clean camp and store food and garbage so it is unavailable to bears.
 Ensure items such as empty food containers are clean and odor free, never bury them.
- Select travel routes between camp and fire and define clearly.
- Carry water and bathe away from lakes and streams. Personnel must not introduce soaps, shampoos or other personal grooming chemicals into waterways.

AVIATION MANAGEMENT

• One of the goals of wilderness managers is to minimize the disturbance caused by air operations during an incident.

Aviation Use Guidelines

- Maximize back haul flights as much as possible.
- Use long line remote hook in lieu of constructed helispots for delivery or retrieval of supplies and gear.
- Take precautions to insure noxious weeds are not inadvertently spread through the deployment of cargo nets and other external loads.
- Use natural openings for helispots and paracargo landing zones as far as practical. If construction is necessary, avoid high visitor use areas.
- Consider maintenance of existing helispots over creating new sites.
- Obtain specific instructions for appropriate helispot construction prior to the commencement of any ground work.
- Consider directional falling of trees and snags so they will be in a natural appearing arrangement.

• Buck and limb only what is necessary to achieve safe/practical operating space in and around the landing pad area.

Retardant Use

- During initial attack, fire managers must weigh the non-use of retardant with the
 probability of initial attack crews being able to successfully control or contain a
 wildfire. If it is determined that use of retardant may prevent a larger, more
 damaging wildfire, then the manager might consider retardant use even in
 sensitive areas. This decision must take into account all values at risk and the
 consequences of larger firefighting forces' impact on the land.
- Consider impacts of water drops versus use of foam/retardant. If foam/retardant is deemed necessary, consider use of foam before retardant use.

HAZARDOUS MATERIALS

Flammable/Combustible Liquids

- Store and dispense aircraft and equipment fuels in accordance with National Fire Protection Association (NFPA) and Health and Safety Handbook requirements.
- Avoid spilling or leakage of oil or fuel, from sources such as portable pumps, into water sources or soils.
- Store any liquid petroleum gas (propane) downhill and downwind from fire camps and away from ignition sources.

Flammable Solids

• Pick up residual fusees debris from the fireline and dispose of properly.

Fire Retardant/Foaming Agents

- Do not drop retardant or other suppressants near surface waters.
- Use caution when operating pumps or engines with foaming agents to avoid contamination of water sources.

Fireline Explosives

Remove all undetonated fireline explosives from storage areas and fireline at the
conclusion of the incident and dispose of according to Bureau of Alcohol,
Tobacco, and Firearms (BATF) and Fireline Blaster Handbook requirements.
Properly dispose of all packaging materials.

FIRE REHABILITATION

Rehabilitation is a critical need. This need arises primarily because of the impacts associated with fire suppression and the logistics that support it. The process of constructing control lines, transport of personnel and materials, providing food and shelter for personnel, and other suppression activities has a significant impact on sensitive resources regardless of the mitigating measures used. Therefore, rehabilitation must be undertaken in a timely, professional manner. During implementation, the resource advisor should be available for expert advice and support of personnel doing this work as well as quality control.

Rehabilitation Guidelines

- Pick up and remove all flagging, garbage, litter, and equipment. Dispose of trash appropriately.
- Clean fire pit of unburned materials and fill back in.
- Discourage use of newly established trails created during the suppression effort by covering with brush, limbs, small diameter poles, and rotten logs in a naturally appearing arrangement.
- Replace dug-out soil and/or duff and obliterate any berms created during the suppression effort.
- Trails constructed as part of the suppression effort should be restored to their original, natural appearance, including restoring the original topography and covering with native mulch (needles, twigs, branches).
- Where soil has been exposed and compacted, such as in camps, on user-trails, at helispots and pump sites, scarify the top 2-4 inches and scatter with needles, twigs, rocks, and dead branches.
- Blend campsites with natural surroundings, by filling in and covering latrine with soil, rocks, and other natural material. Naturalize campfire area by scattering ashes in nearby brush (after making sure any sparks are out) and returning site to a natural appearance.
- Where trees were cut or limbed, cut stumps flush with ground, scatter limbs and boles, out of sight in unburned area. Camouflage stumps and tree boles using rocks, dead woody material, fragments of stumps, bolewood, limbs, soil and fallen or broken green branches. Scattered sawdust and shavings will assist in decomposition and be less noticeable. Use native materials from adjacent, unimpacted areas if necessary.
- Remove newly cut tree boles that are visible from trails or meadows. Drag other highly visible woody debris created during the suppression effort into timbered areas and disburse. Tree boles that are too large to move should be slant cut so a minimal amount of the cut surface is exposed to view. Chopping up the surface

with an axe or pulaski, to make it jagged and rough, will speed natural decomposition.

- Leave tops of felled trees attached. This will appear more natural than scattering the debris.
- Consider using explosives on some stumps and cut faces of the bolewood for a more natural appearance.
- Tear out sumps or dams, where they have been used, and return site to natural condition. Replace any displaced rocks or streambed material that has been moved. Reclaim streambed to its pre-disturbed state, when appropriate.
- Walk through adjacent undisturbed area and take a look at your rehab efforts to determine your success at returning the area to as natural a state as possible.

DEMOBILIZATION

Because demobilization is often a time when people are tired or when weather conditions are less than ideal, enough time must be allowed to do a good job. When moving people and equipment, choose the most efficient and least impactive method to both the landscape and fire organization mission. An on-the-ground analysis of "How Things Went" will be important.

POST-FIRE EVALUATION

Post-fire evaluation is important for any fire occurrence so management can find out how things went. Identify areas needing improvement, to formulate strategies and to produce quality work in the future. This activity is especially important in sensitive areas due to their fragility and inclination to long-term damage by human impacts. Resource advisors and park rangers will be responsible for conducting the post-fire evaluation.

Post-fire evaluation will consist of data collection, documentation and recommendations. This process and report will, in most cases, be fairly simple and to the point. It should be accomplished before an overhead team departs from the fire. The evaluation emphasis should be on the MIST actions and not on the effects on the fire.

Data Collection/Documentation/Recommendations

This phase will be completed by a review of the rehab plan and visit to the fire site as soon after demobilization as possible. Observations will be documented in a brief report to the line officer with a copy to the appropriate incident commander and Park Supervisor. In the report, the evaluator will include recommendations for ensuing fire suppression activities in the future. It is important that the evaluator recognize and commend the initial attack forces or overhead team for positive activities. Make special note of the extra efforts and sensitivity to suppression impacts. Attached is a sample format for a Post-Fire Evaluation Report:

POST-FIRE EVALUATION

for

(Name of Fire)

A. Resource Advisor Input and/or Actions:

(SHOULD INCLUDE A SYNOPSIS OF THE ACTIONS OF THE RESOURCE ADVISOR AND HIS INPUT INTO SUPPRESSION STRATEGIES/TACTICS)

B. Escaped Fire Situation Analysis (EFSA)

(HOW DID THE EFSA RESPOND TO THE SENSITIVITIES OF THIS FIRE AREA)

C. Line Direction to Incident Commander

(SYNOPSIS OF WHAT THE LINE OFFICER TOLD THE INCIDENT COMMANDER TO DO)

D. Incident Action Plan

(SYNOPSIS OF HOW INCIDENT ACTION PLAN RESPONDED TO FIRE AREA)

E. On-Site Verification

(STATE HERE WHO MADE THE FIELD VISIT, THE DATE, AND WHAT OBSERVATIONS WERE MADE IN TERMS OF MEETING THE GUIDELINES FOR MIST)

F. Overall Review Evaluation

(INCLUDE OVERALL FINDINGS OF HOW WELL OBJECTIVES WERE ACCOMPLISHED IN TERMS OF MINIMUM IMPACT ACTIVITIES)

G. Review Recommendations

(WHAT AREAS CAN WE IMPROVE ON, WHERE DID WE DO GOOD, ETC.)

Prepared from a variety of sources including:

- TRPA Best Management Practices
- Objectives and Guidelines for Revegetation Success Under the Nevada Tahoe Bond Act, May 14, 1999, M. Hogan
- NV Tahoe Resource Team Professional Experience, Field Work and Professional Judgement